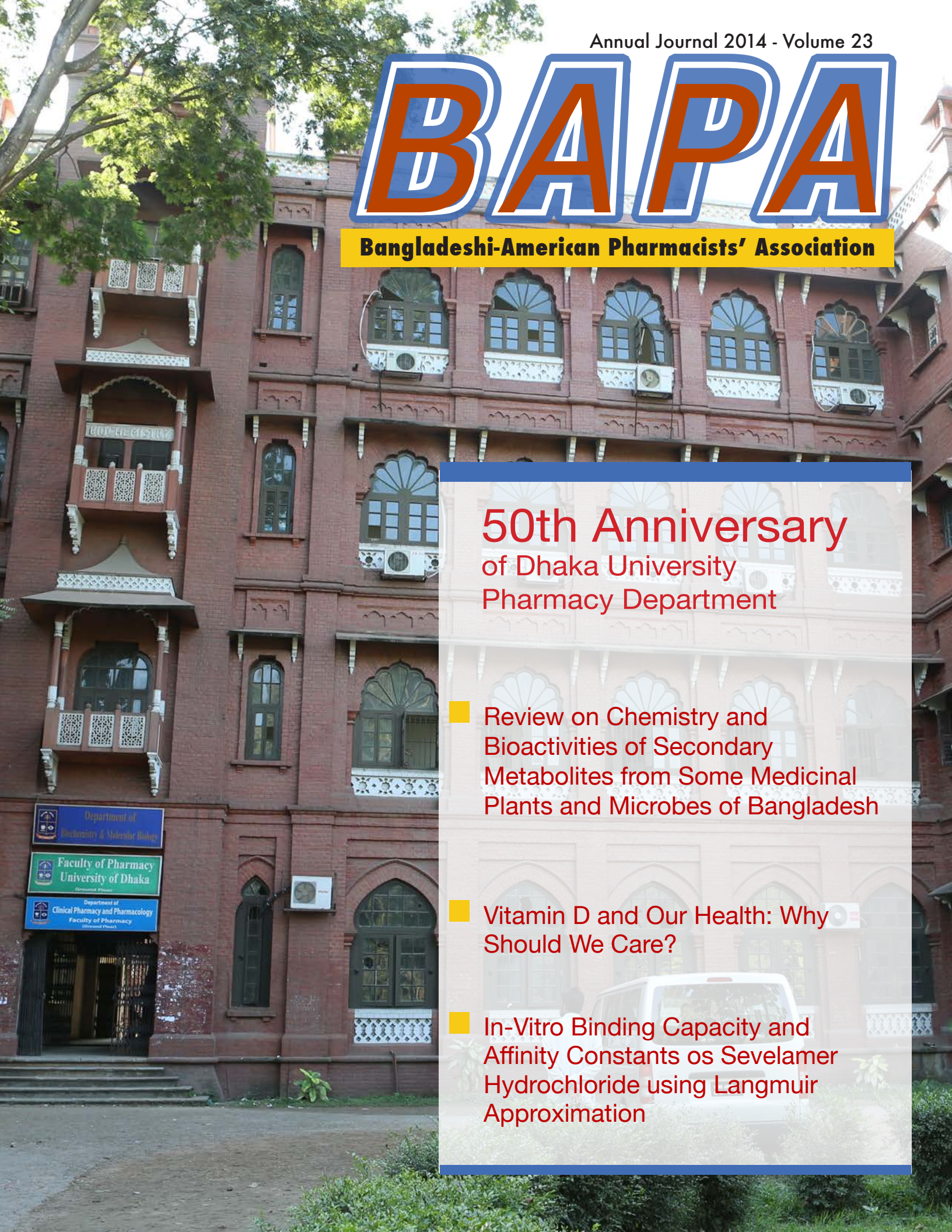
Annual Journal 2014 - Volume 23

BAPA

Bangladeshi-American Pharmacists' Association



50th Anniversary
of Dhaka University
Pharmacy Department

- Review on Chemistry and Bioactivities of Secondary Metabolites from Some Medicinal Plants and Microbes of Bangladesh
- Vitamin D and Our Health: Why Should We Care?
- In-Vitro Binding Capacity and Affinity Constants os Sevelamer Hydrochloride using Langmuir Approximation

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Abu M. Kabir

1952-2014

Our dearest friend, colleague, ex-BAPA President and overall a vey kind generous man passed away on 16th May, 2014.

We have lost an amazing human being , a mentor and a friend.

No words can adequately express our sadness at Kabir's death or our gratitude for the opportunity to be of his acquaintance. We will honor his memory by continuing to help each other and love and respect the way he did to us and people around him.

Lifetime Members

MD M ABDULLAH
MONIR UDDIN AHAMED
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SHAHAB AHMED
SHARIF AHMED
QAMRUL AHSAN (Kanchan)
MOHAMMAD SHAFIUL ALAM
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ABDUL AWAL SIDDIQUI
SAYED T SULTAN
TAHMINA SULTAN
LEETU MOHAMMED ZAMAN

Departed Souls

We deeply regret and mourn the departure of our fellow friends. We miss them a lot and remember them in our prayers. In this day of the Convention we will miss their presence.

Abdullah Al Sad
Abu M Kabir
Dr. Faisal
Kamrul Khan
Manju Biswas
Mohammad Azim
Mohammad Sikandar
Mohammed Fazli Hussain
Mohammed Wahidur Rahman
Muzammel Khan
Nazir Ahmed
Qamrul Huda Fiaz
Dr. Rashid
Sujash Chandra Guha Roy
Utpal Kanti Biswas

Disclaimer: If we missed anybody's name it is an unintentional mistake.

EDITORIAL

Table of Contents

Sections

BANGLADESHI – AMERICAN PHARMACISTS' ASSOCIATION

23rd Annual Convention Programs
August 22nd, 23rd and 24th, 2014

HONOR'S HAVEN RESORT & SPA

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BAPA CONVENTION SCHEDULE AT-A-GLANCE

Day 1	Friday, August 22, 2014
2:00 PM - 8:00 PM	Registration, Hotel Lobby
5:00 PM - 6:00 PM	CE Registration
6:00 PM - 8:00 PM	Continuing Education: Part One: Drug Interaction of Herbals, Vitamins and Nutritional Supplements with Prescription Drugs Part Two: Drug Depletion of Nutrients - How Pharmacists can Intervene Speaker: Dr. Kazi Anam. M.S., RPh., FASCP,ND **CEU: 2**
8:00 PM - 10:00 PM	Dinner
10:00 PM - 1:00 AM	Cultural Program by various Artists

Day 2	Saturday, August 23, 2014
7:00 AM - 9:00 AM	Breakfast
9:00 AM - 12:00 PM	Continuing Education: Medication Error Speaker: Karl D. Fiebelkorn, MBA, RPh, AE-C. , Associate Dean, UB School of Pharmacy & Pharmaceutical Sciences **CEU: 3**
10:30 AM - 10:45 AM	Coffee Break
12:00 PM - 1:00 PM	Drug Development Strategy - A Regulatory Overview Speaker: Naushad Islam, M.S.(MKTG); M.S. (DRA); Associate Prof. DRA, LIU-Brooklyn

1:00 PM - 2:00 PM	Lunch
2:00 PM - 3:00 PM	Continuing Education: Pharmacy Law Update Speaker: Karl D. Fiebelkorn, MBA, RPh, AE-C., Associate Dean, UB School of Pharmacy & Pharmaceutical Sciences **CEU: 1**
3:00 PM - 5:00 PM	Continuing Education: 2013 ACC-AHA Blood Cholesterol Guidelines: An Update on Statin Use Speaker: Jennifer Bhuiyan, Pharm.D, Former Clinical Assistant Professor at Northeastern University School of Pharmacy in Boston, MA, Specializations: Underserved Care, Global Health, Primary Care **CEU: 2** Topic: 2013 ACC-AHA Blood Cholesterol Guidelines: An Update on Statin Use
7:30 PM - 10:00 PM	Dinner and Reception – Formal Attire
10:00 PM - 2:00 PM	Cultural Program

Day 3	**Sunday, August 24, 2014**
8:00 AM - 10:00 AM	Breakfast
9:00 AM - 11:00 AM	Continuing Education: Aligning the Stars: Pharmacy Quality Measurements and Community Pharmacy Practice Speaker: David Baker, Pharm.D, Director of Managed Care for Pharmacy Quality Solutions, Inc. **CEU: 2**
12:00 PM	Check Out (Luggage can be retained in 2 holding rooms by the hotel)
12:00 PM - 4:00 PM	Outdoor Barbeque and Sports Activities

For further update or changes, please visit our website at http://www.bapainfo.org

Message from the PRESIDENT

Mohammad
IQBAL RASHED

Dear BAPA members,

I am humbled and honored to represent the members of Bangladeshi-American Pharmacists' Association (BAPA) as president and would like to take the opportunity to welcome you all at the 23rd Annual BAPA Convention of 2014. I choose to be considered for this position for two reasons. First, to take care of those members -- who were the founders of this organization and encouraged us, the new generation Pharmacists to be more involved. They set an example of dedication and service that we hope to build upon. Secondly, as a pharmacist we are not just health care providers, we are also leaders of our community. I believe that it is our responsibility not just to care for patients during work hours only but also to have a deep sense of responsibility for the wellbeing of the community. As fellow members of BAPA, I hope that we cherish the same commitment as we are more of similar than dissimilar. I would like to keep these two themes at the forefront of all that we do in the coming year.

I am sure you would agree with me that this year's convention will be a remarkable one due to Golden Jubilee of Pharmacy Profession in Bangladesh. The department of Pharmacy, University of Dhaka was founded on 1964. This is exciting to imagine that we came across such a long journey where we have successes and failures. Pharmacists at home and abroad did remarkable success for which we all are proud of. I would like to salute all our fellow Pharmacists who fought for the rights of Pharmacists in Bangladesh. I do sincerely believe that you all became nostalgic thinking about the past. I would like to congratulate all of you at eve of 50th Anniversary.

On a serious note, I cannot think of myself without the unprecedented support of my Baro Mama, Mr. Mohammad Rafiqul Islam. What I am today is due to him. It would be quite impossible for me to become a pharmacist without his cooperation and guidance. I also want to thank Mr. Mohammed Saleh and Mr. Sharif Ahmed. Mr. Mohammed Saleh has stood by me and encouraged me every step of the way since I started pharmacy school.

Furthermore, I would like to thank all our fellow members, advertisers, and sponsors for their consistent financial support for our Association. Without this support and their participation, this event cannot achieve such success.

My sincere thanks go to our current executive committee for making this such a successful convention. I wish all of you an enjoyable and successful Convention, 2014.

Mohammad I Rashed, PharmD, RPh

President

Message from the VICE PRESIDENT

Dear BAPA members,

First and foremost, I want to thank you for electing me as your Vice President . It is truly an honor and I feel blessed to be able to serve in a senior leadership role in this organization.

This is my fifth year serving on the BAPA Executive Committee. I am grateful I have been able to work with some of the finest pharmacists and individuals I know. The lessons I have learned over the years I will always carry with me.

I have attended numerous conferences and BAPA members have always made me feel so at home. I have come to realize that when you are a member of BAPA, it is not just about serving the members and profession; you serve the whole community. We are not just one profession, but one community.

I would like to add to our President's message about the New Generation of Pharmacists. Our time is now; we have guided and prepared by our elders in the profession. Now is the time to take on the responsibility for the organization which they have built for us and to make it even better. Let's join together to advance the profession to increase our scope of practice. Let's join together to make difference in the lives of our patients and our community one person at a time.

I hope everyone has a wonderful time at the convention and thank you for your continuous support.

Mohammed Shabbir Taher

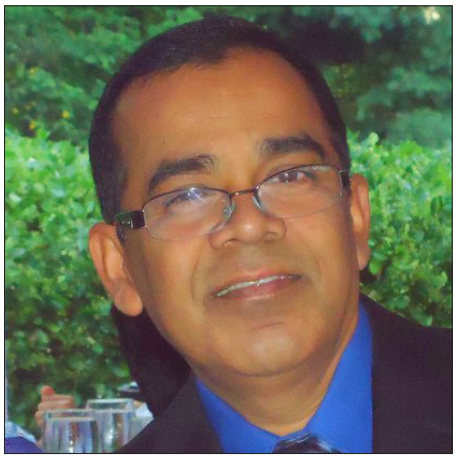
Vice President

Mohammed
SHABBIR TAHER

Message from the GENERAL SECRETARY

Dear BAPA members

I feel quite privileged, honored to serve as a General Secretary of BAPA, and wish to take this opportunity to welcome all of you to the 23rd Annual BAPA Convention of 2014.BAPA has been an integral part of our profession as well social life which binds all of us as a single family. Likewise, we feel delighted and enlightened at the success of our fellow members, and conversely, we feel sad at any sad news of our fellow members. This makes BAPA a unique revered Organization for which we all are proud of. BAPA Annual Convention is a grand celebration of professional and family gathering for which we always are looking for. In our daily busy schedule, we rarely get time to mingle, BAPA Annual Convention gives us the opportunity to further our knowledge and family gathering.



Mohammed
MOHIUDDIN

This year's Convention is especially important because of Golden Jubilee of Pharmacy profession in Bangladesh. Congratulations of all our fellow members at home and abroad on the eve of the 50th anniversary of the department of Pharmacy, University of Dhaka, which was founded in 1964.Over the last 50 years of Pharmacy Profession, Pharmacy Graduates achieved enormous success at home and abroad in various arenas. Due to the greatness and hugeness of our profession, we are indeed proud of it.

On a personal note, we have been fortunate that we have unlimited number of fellow members who made BAPA a vibrant and positive organization. For this we are grateful to them. I am sure that BAPA will be stronger and will continue to make invaluable contributions to our community in the days to come.

Furthermore, we publish BAPA Journal Annually. I would like to express my sincere gratitude to the Editorial Board, including all contributed to make the Journal rich and resourceful, specifically to the editor of the Journal, Mr.Devabrata Mondal, MS, R.Ph for his consistent support. I also would like to thank all the advertisers, sponsors, patrons, and all our fellow members who have time and again supported our Association freely through their unprecedented financial help. Without this support and their participation, this event cannot achieve the success that it so deserves.

I wish you all the most enjoyable and successful, BAPA Convention, 2014 and a wonderful 50th Anniversary.

Md Mohiuddin

General Secretary

Message from the TREASURER

Dear BAPA members,

Thank you for giving me the opportunity to serve as BAPA Treasurer. It is an exciting time for BAPA as we look to bring new ideas in while maintaining what has made this organization great for so many years. Much credit must be given to the President and Vice President for organizing this convention.

I hope to maintain the level of excellence of those that came before me while creating a new path as we move towards the future.

This is an exciting time for BAPA as the convention is always a wonderful opportunity to meet new people, eat good food, and earn continuing education credits. Every year we have a nice mixture of pharmacists from different environments - from administration, clinical, hospital, retail, industry, and many more.

I look forward to working with the new committee and am open to any new ideas and suggestions. Best Wishes!

Fahim Ahmed
Treasurer

Fahim
AHMAD

Articles

Articles

IN-VITRO BINDING CAPACITY AND AFFINITY CONSTANTS OF SEVELAMER HYDROCHLORIDE USING LANGMUIR APPROXIMATION

Sitesh C Bachar[1]* and Sushanta Biswas[2]

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[2] Beximco Pharmaceutical Li,mited, Tongi, Gazipur, Dhaka, Bangladesh

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Abstract

Sevelamer is a weakly basic anion exchange resin consisting cross-linked polymeric amine that binds dietary phosphate in the gastrointestinal tract. This is used in the treatment of hyperphosphatemia in patients with end-stage renal disease. The binding capacity and affinity constants of sevelamer hydrochloride were determined in-vitro using the Langmuir approximation and generic tablet dosage form at pH 4.0, 5.5 and 7.0. The results demonstrate the equivalency of the dosage form at each pH in terms of the in vitro binding parameters.

Keywords: Sevelamer hydrochloride; Ion chromatography; Langmuir approximation; affinity constant; Renagel, Sevel.

Introduction

Hyperphosphatemia and secondary hyperparathyroidism are common complications of end stage renal disease (ESRD) that, when untreated, may result in increased morbidity and mortality.[1] Hyperphosphatemia and hypercalcemia have been associated with increased coronary artery calcification. Achieving control of serum phosphorus without increasing serum calcium is an important goal for patients with ESRD.[2] Although calcium-based phosphate binders effectively reduce serum phosphorus and parathyroid hormone concentrations, these agents can lead to hypercalcemia and have been associated with increased vascular calcification. Aluminum hydroxide is a potent phosphate binder, but concern about skeletal, hematological, and neurological toxicity. [3]

The phosphorus binder sevelamer [4] was developed to overcome the limitations associated with the usual management of hyperphosphatemia and secondary hyperparathyroidism (i.e., mineral salts). Sevelamer, a non-absorbable hydrogel, is as efficacious as calcium-based phosphate binders for reducing serum phosphorus but does not cause hypercalcemia or other adverse metabolic effects. Sevelamer also exhibits beneficial effects on lipids, consistently and significantly decreasing LDL cholesterol and increasing HDL cholesterol in most studies.[5]

Sevelamer hydrochloride is a well-tolerated alternative to calcium- or aluminum-containing phosphate binder in the control of serum phosphate in CAPD (continuous ambulatory peritoneal dialysis) patients. Subsequently, the importance of Sevelamer hydrochloride is increasing for hyperphosphatemia.

Renagel tablet (sevelamer HCl) administered orally is the brand product of Genzyme Corporation, UK and is being used for the treatment of hyperphosphatemia. Pharmacology, pharmacokinetics study, side effects, contraindications, precautions, efficacy, effectiveness, bioequivalence, clinical study and others study of Renagel tablet was approved by the FDA.

This non-absorbable, non-systemic drug is formulated by a Bangladeshi manufacturer as generic drug containing sevelamer hydrochloride 400mg. The equivalency in terms of efficacy of the tablet 400 mg was taken into consideration to compare with Renagel 400mg tablet using in-vitro study. This in-vitro equivalence study was performed using Langmuir approximation equation approved by FDA.

Utilizing Langmuir equation the binding affinity constant (K_1) and capacity constant (K_2) of non-absorbable sevelamer HCl and its market preparations (Sevel 400 tablet) were determined and compared with innovator drug, Renagel 400mg tablet. Thus the present study was designed to evaluate the in-vitro equivalence of Sevelamer hydrochloride generic preparation available in our markets with the innovator product.

Materials and Methods

Sevelamer hydrochloride powder (API) and reference formulation Renagel 400 tablet manufactured by Genzyme Corporation, Ireland, UK, containing sevelamer HCl 400mg were subblied by ACME Laboratories Ltd. Bangladesh. The generic tablet preparation of sevelamer hydrochloride trade name Sevel 400 (B 3001), Sevel 400 (B 3002), Sevel 400 (B 3003) tablet as test products manufacturing by ACME Laboratories Ltd, Dhaka, Bangladesh was collected from local market. Potassium monobasic Phosphate, N,N-Bis(Hydroxyetyl)-2-aminoethanesulfonic acid (BES), Sodium chloride, Sodium hydroxide, Sodium carbonate, Sodium bicarbonate, Methanol are obtained from Sigma-Aldrich, USA and Sulphuric Acid was obtained from Merck, Germany. All chemicals were of ACS grade or higher and were used without further purification. Deionized water was obtained from an in-house Barnstead Nanopure System Barnstead/Thermolyne Corporation, Dubuque, IA). Labline heated orbital shaker (Labline 3520 orbital shaker, Hyland scientific, USA) and Ion chromatography (Model no: 881 Compact IC pro 1, Metrohm Ltd., Switzerland), were used in conduction of the study.

Preparation of mobile phase : 1mM $NaHCO_3$ and 3.2 mM Na_2CO_3 solution

In a one liter volumetric flask 80mg $NaHCO_3$ and 340 mg Na_2CO_3 were taken and dissolved them with deionized H_2O made up to one liter. Then the solution was sonicated and filtered through 0.22 micron vacuum filter paper.

Preparation of H_2SO_4

In a 1000 ml volumetric flask 5.5 ml conc. H_2SO_4 was and diluted with 994.5 ml deionized H_2O. The solution was sonicated and then filtered through 0.22 micron vacuum filter paper.

Preparation of Standard Phosphate Solution

Three sets of 250 ml volumetric flask were taken. Each set was marked at 8 different phosphate concentration such as 38.7 mM, 30.0 mM, 14.5 mM, 10.0 mM, 7.5 mM, 5.0 mM, 2.5 mM, 1.0 mM. Required amount of KH_2PO_4 was taken appropriately by calculation for 8 different phosphate concentrations. NaCl 701.28 mg (80 mM) and N,N-Bis(hydroxiethyl)-2-aminoethanesulfonic acid (BES) 3198.75 mg (100 mM) was weighed and added for all the volumetric flasks so that all the solutions contain the same concentration of BES and NaCl for maintaining gastrointestinal tract (GIT) chemical environment in-vitro. The final solution was made up to 150 mL by addition of de-ionized water. Such sets of solutions were prepared for three different pH (4.0, 5.5 and 7.0) levels adjusted by 1.0 N hydrochloride acid and 1.0 N sodium hydroxide. Then all the solutions were placed in Labline Heated Orbital Shaker at 37 ^oC temperatures for 2 hours for maintaining GIT in-vitro. The sample flasks were removed from Orbital Shaker and filtered through a 25 mm, 0.2 micro meter nylon syringe filter. The solutions were fifty times diluted with deionized water. All the drug-free standard samples were prepared in duplicate for different pH levels.

Preparation of Sample Solution

As per above design to 150 ml phosphate solutions, Sevelamer HCl 400mg (API), Renagel 400mg tablet, Sevel 400 tablet (B 3001), Sevel 400 mg tablet (B 3002) and Sevel 400 mg tablet (B 3003) were added for pH 4.0, pH 5.5 and pH 7.0 accordingly. The pH levels of the solutions were adjusted using 1.0 N hydrochloride acid and 1.0 N sodium hydroxide accordingly. All the solutions were placed in Labline Heated Orbital Shaker at 37^0 C temperatures for 2 hours for maintaining GIT condition in-vitro. The sample flasks were removed from Orbital Shaker and filtered through a 25 mm, 0.2 micro meter nylon syringe filter. The solutions were fifty times diluted with deionized water. All the test samples were prepared in duplicate for different pH levels. For all solutions the test was performed in triplicates.

Chromatographic conditions

Injector: Auto injector; Column: Polyvinyl alcohol with quaternary ammonium; 150 × 4.0 mm; Detector: Conductivity detector; Eluent composition: 1mM sodium bicarbonate and 3.2 mM sodium carbonate; Flow rate: 0.7 mL/min, Injection volume: 20 µL; Software: Magic Net. An ion chromatogram of standard phosphate solution was shown in Fig. 1.

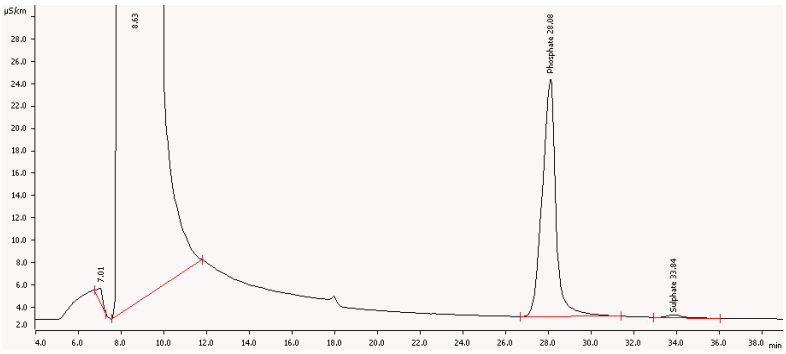

Fig. 1. Ion Chromatogram of 2.5 mM Standard Phosphate

Calculations using Langmuir approximation

The remaining unbound phosphate in terms of concentration in each sample was calculated from the linear regression line obtained from a plot of area of the phosphate peak versus the concentration of the phosphate (mM) using the following equation : [6]

$$\textbf{Unbound phosphate concentration (mM)} = \frac{\textbf{area phosphate} - \textbf{intercept}}{\textbf{slope}}$$

From the known initial concentration of phosphate in each solution (i.e. 38.7, 30.0, 14.5, 10.0, 7.5, 5.0, 2.5, and 1.0 mM) before the addition of sevelamer hydrochloride, the bound concentration was calculated by subtracting the unbound concentration from the initial concentration. [6]

Bound phosphate concentration (mM) =

initial concentration (mM) – unbound phosphate concentration (mM)

The binding capacity, in mmol of phosphate /g of polymer, was calculated as follows : [6]

$$\textbf{Phosphate binding capacity} \left(\frac{\textbf{mmol}}{\textbf{g}}\right) = \frac{\textbf{bound phosphate concentration (mM)} \times \textbf{Vs(L)}}{\textbf{Weigh (g)}}$$

Where, Vs is the volume of the solution, approximately 150 ml or 0.15 L for the 400 mg tablet and powder. The weigh is the weight of the sevelamer hydrochloride expressed in (g).

The phosphate binding constants were calculated from the Langmuir approximation. The Langmuir approximation describes the monomolecular adsorption of an adsorbate (phosphate) from solution, at constant temperature onto an adsorbent (sevelamer hydrochloride). [7] The process is described by the Langmuir equation:

$$\frac{C_{eq}}{\frac{x}{m}} = \frac{C_{eq}}{K_2} + \frac{1}{K_1 K_2}$$

Where Ceq is the concentration of phosphate remaining in mM in solution at equilibrium or the unbound concentration. The x/m is the amount of phosphate bound per weight of polymer in mM/g. The constant K_1 is the affinity constant involved in binding and related to the magnitude of the forces. The constant K_2 is the Langmuir capacity constant and is the maximum amount of that can be bound per unit weight of sevelamer hydrochloride.[6]

The affinity constant and Langmuir capacity constants were calculated by performing linear regression on a plot of the unbound phosphate concentration (mM) / binding capacity (mM/g) versus unbound phosphate concentration (mM). The K_1 (= a/b) value is calculated by dividing the slope (a) of the regression line by the intercept (b), the K_2 (= 1/a) value is equal to the inverse of the slope.

Results

The present study was designed to evaluate the in-vitro equivalencey of sevelamer hydrochloride generic preparation available in Bangladeshi markets with the reference formulation. The equivalency in terms of efficacy of generic Sevel tablet 400mg of three different batches B 3001, B 3002 and B 3003 was designated as Sevel B 3001, Sevel B 3002 and Sevel B 3003; and was compared with the reference formulation Renagel 400mg tablet using in-vitro study. This in-vitro equivalence study was performed using Langmuir approximation equation. [6] In Langmuir equation the binding affinity constant (K_1) and capacity constant (K_2) of Sevelamer HCl and its market preparations (Sevel 400 tablet) were determined and compared with reference product Renagel 400mg tablet.

Calibration curve of KH_2PO_4

Eight different concentration of KH_2PO_4 solution were prepared and obtained eight different types of peak areas through ion chromatography. Each solution contains 80 mM NaCl and 100 mM N,N-Bis(hydroxiethyl)-2-aminoethanesulfonic acid (BES) as incubation media for maintaining the chemical environment of GIT in-vitro. All solutions were kept at Labline orbital shaker for 2.0 hours at 37 °C for maintaining the physical condition of the GIT. Calibration curves were obtained for pH 4.0 (Fig. 2), pH 5.5 (Fig. 3) and pH 7.0 (Fig. 4). These different pH levels are observed in different portions in the GIT and were adjusted either by adding 1.0 N HCl or 1.0 N NaOH in the experimental laboratory. The RSQ values are 0.9999, 0.9998 and 0.9999, slopes 6.801, 7.070 and 7.109 and intercepts were -0.9542, -1.4086 and -1.471 for pH 4.0, pH 5.5 and pH 7.0 respectively (Table 1). These values specially the slopes and intercepts were used in the calculation of unbound phosphate according to Langmuir approximation equation. And the bound concentration was calculated by subtracting the unbound concentration from the initial phosphate concentration before the addition of sevelamer HCl API or its dosage forms.

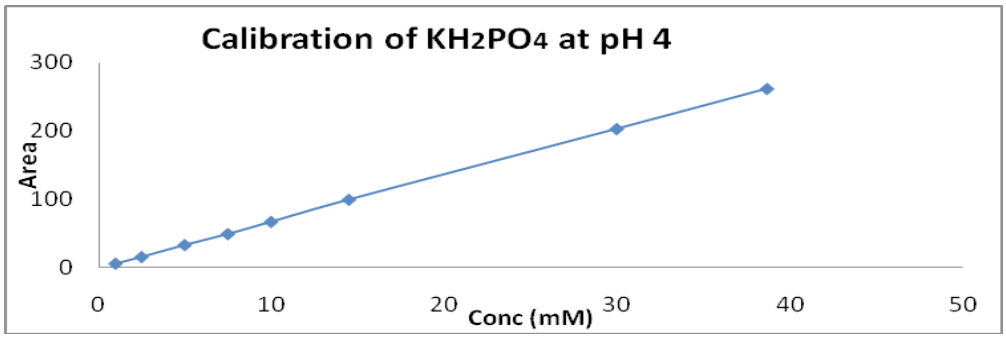

Fig. 2. Calibration curve of KH_2PO_4 at pH 4.0

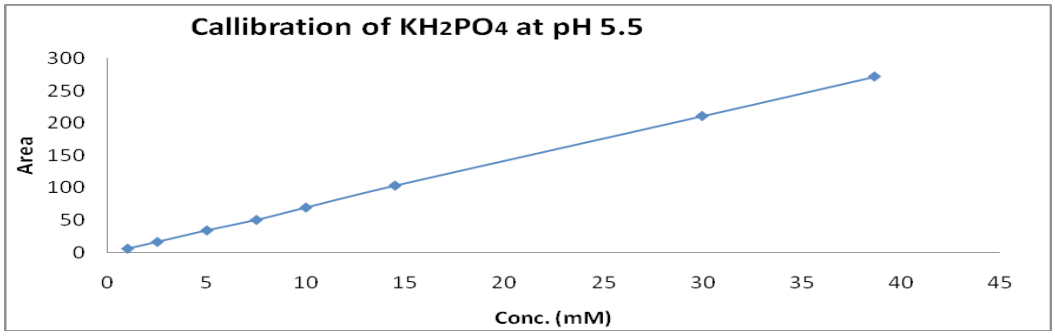

Fig. 3. Calibration curve of KH_2PO_4 at pH 5.5

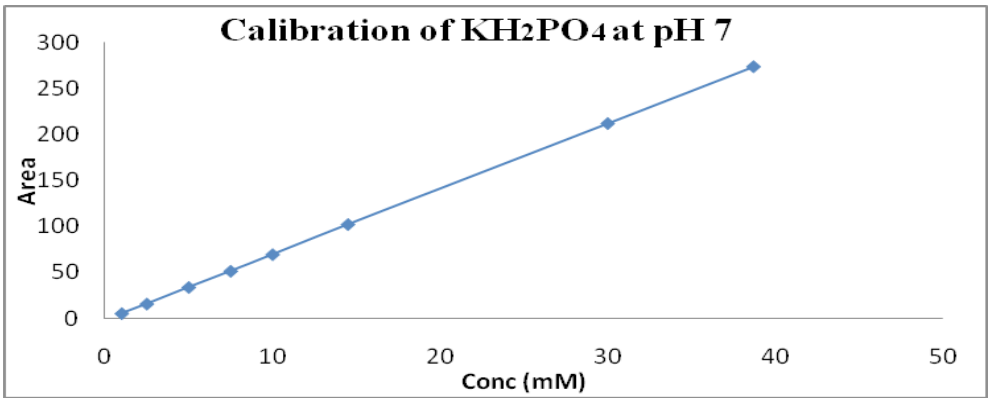

Fig. 4. Calibration curve of KH_2PO_4 at pH 7.0

Table 1. Data of the calibration curve at all pHs.

	pH 4	pH 5.5	pH 7
RSQ	0.9999	0.9998	0.99999
Slope	6.801	7.070	7.109
Intercept	-0.9542	-1.4086	-1.471

Percentage of unbound and bound phosphate at different pH levels

The unbound phosphate concentration (mM) remaining in each sample was calculated from the

linear regression generated plot of area of the phosphate peak against the initial concentration (mM) using intercept and slope of the respective pH according to Langmuir. [6] Thus bound phosphate concentration (mM) was also obtained by subtracting unbound phosphate concentration from initial phosphate concentration. At pH 4.0 using the active sevelamer HCl as binding agent the percentage of bound phosphate were higher in lower initial concentration as compare to the higher initial concentration of phosphate. At lower phosphate concentrations 1.0, 2.5, 5, 7.5, 10 and 14.5 mM the percentage of bound phosphate was 82.5, 70.02, 79.18, 78.20, 76.34 and 72.59% and at higher phosphate concentrations 30 and 38.7 mM, the percentage of bound phosphate concentration was 52. 42 and 44.61 % respectively.

Similarly at pH 4.0 using the reference product Renagel 400 containing sevelamer HCl as binding agent the percentage of bound phosphate at lower phosphate concentrations 1.0, 2.5, 5.0, 7.5, 10 and 14.5 mM was 75.15, 65.85, 60.20, 52.60, 49.87 and 47.50 % and at higher phosphate concentrations 30 and 38.7 mM, the percentage of bound phosphate concentration was 36.73 and 35.36 %.

At pH 4.0 using the test preparation Sevel 400 (B 3001) containing sevelamer HCl as binding agent the percentage of bound phosphate at concentrations 1.0, 2.5, 5, 7.5, 10 and 14.5 mM was 74.15, 69.21, 63.97, 53.85, 52.43 and 48.54 % and at higher phosphate concentrations 30 and 38.7 mM, the percentage of bound phosphate concentration was 38.62 and 36.22 %. For the test preparation Sevel 400 (B 3002) the percentage of bound phosphate at concentrations was 75.15, 66.25, 59.34, 52.45, 50.31 and 47.49 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 32.88 and 28.27 %. For test preparation Sevel 400 (B 3003) the percentage of bound phosphate at concentrations was 73.87, 65.01, 60.09, 52.06, 50.35 and 47.83 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 36.67 and 33.45 % .

At pH 5.5 using the active sevelamer HCl as binding agent the percentage of bound phosphate was higher in lower initial concentrations as compare to the higher initial concentrations of phosphate as that of pH 4.0. At lower phosphate concentrations 1.0, 2.5, 5.0, 7.5, 10 and 14.5 mM the percentage of bound phosphate was 79.92, 89.72, 88.92, 89.12, 87.15 and 83.30 % and at higher phosphate concentrations 30 and 38.7 mM, the percentage of bound phosphate concentration was 61.33 and 50.11 %.

Similarly at pH 5.5 using the reference product Renagel 400 containing sevelamer HCl as binding agent the percentage of bound phosphate at lower phosphate concentrations was 80.64, 91.90, 89.95, 89.14, 87.72 and 84.65 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 66.62 and 54.92 %. For the test preparation Sevel B 3001 containing sevelamer HCl as binding agent the percentage of bound phosphate at lower phosphate concentrations was 79.65, 85.07, 80.95, 83.27, 76.45 and 72.45 % and at higher phosphate concentrations the percentage

of bound phosphate concentration was 56.25 and 46.33 %. For the preparation Sevel B 3002 the percentage of bound phosphate at lower phosphate concentrations was 78.96, 85.81, 81.86, 83.54, 77.67 and 73.09 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 59.77 and 48.64 %. Similarly the test product Sevel B 3003 the percentage of bound phosphate at lower phosphate concentrations was 79.75, 88.59, 83.17, 85.15, 77.97and 75.47 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 59.29 and 49.75 %.

At pH 7 using the active sevelamer HCl as binding agent the percentage of bound phosphate were higher in lower initial concentration as compare to the higher initial concentration of phosphate as that of pH 4 and pH 5.5. At lower phosphate concentrations 1.0, 2.5, 5.0, 7.5, 10 and 14.5 mM the percentage of bound phosphate was 79.29, 86.25, 84.26, 80.13, 78.21 and 63.80 % and at higher phosphate concentrations 30 and 38.7 mM, the percentage of bound phosphate concentration was 40.24 and 46.15 %. Similarly at pH 7 using the reference product Renagel 400 the percentage of bound phosphate at lower phosphate concentrations was 78.98, 90.69, 90.99, 85.67, 84.65 and 78.37 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 50.10 and 40.29 %. For the test product Sevel B 3001 the percentage of bound phosphate at lower phosphate concentrations was 78.46, 91.87, 92.78, 90.22, 85.03 and 78.86 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 56.50 and 46.86 %. For the test product Sevel B 3002 the percentage of bound phosphate at lower phosphate concentrations was 78.35, 90.65, 91.63, 87.92, 83.57 and 76.87% and at higher phosphate concentrations the percentage of bound phosphate concentration was 53.14 and 41.76 %. And for Sevel B 3003 containing sevelamer HCl as binding agent the percentage of bound phosphate at lower phosphate concentrations was 78.96, 91.99, 92.61, 89.56, 84.95 and 79.16 % and at higher phosphate concentrations the percentage of bound phosphate concentration was 54.99 and 44.29 %.

Langmuir approximation [6] plot at pH 4.0

At pH 4 using active sevelamer HCl as binding agent the affinity constant (K_1) and binding capacity constant ($K_{2)}$ values were determined by plotting unbound phosphate concentration (mM) / binding capacity (mM/gm) versus unbound phosphate concentration (mM) at this pH (Table 2). The RSQ value, slope and intercept of the regressed plot were determined and the K_1 and K_2 values were obtained from these values respectively for samples respectively.

The combined Langmuir plot of unbound phosphate verses unbound phosphate/binding capacity at pH 4 of Sevelamer HCl (API), Renagel 400 mg tablet, Sevel 400 mg tablet (B 3001), Sevel 400 mg tablet (B 3002) and Sevel 400 mg tablet B 3003 were shown in Fig. 5. The Langmuir affinity constant (K_1), binding capacity constant (K_2), RSQ, slope and intercept were very similar for all samples at this

pH as shown in Table 2.

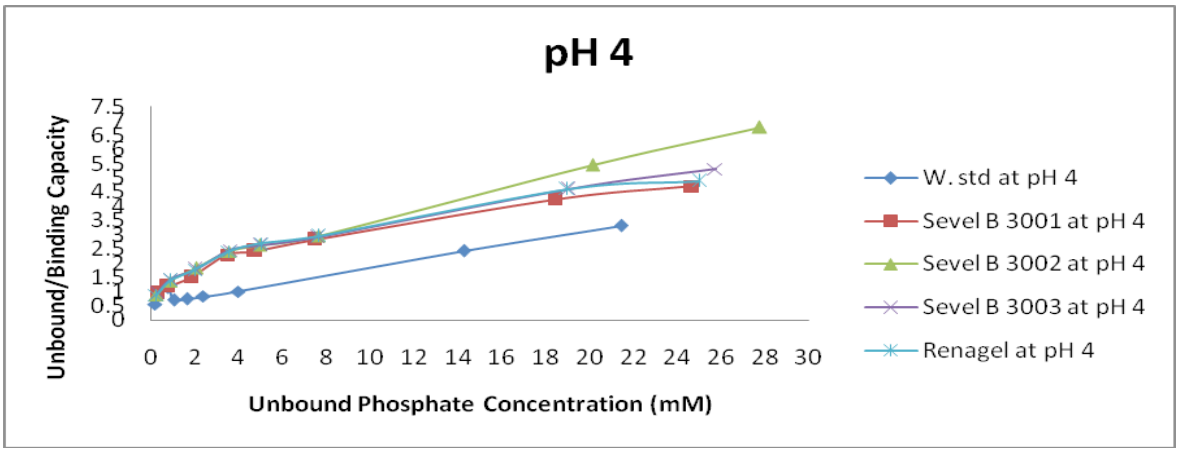

Fig. 5. Langmuir plot of working standard (Sevelamer HCl), Renagel 400 mg, Sevel 400 (B 3001), Sevel 400 (B 3002), and Sevel 400 (B 3003) at pH 4.0

Table 2. The Langmuir capacity and affinity constants of reference and test products calculated at pH 4.0

	Sevelamer (API)	Renagel 400	Sevel 400 (B 3001)	Sevel 400 (B 3002)	Sevel 400 (B 3003)
RSQ	0.9680	0.9230	0.9348	0.9816	0.9504
Slope	0.1242	0.1504	0.1472	0.2005	0.1578
Intercept	0.6305	1.5002	1.3760	1.3507	1.4941
k_2	8.0503	6.6457	6.7907	4.9874	6.3350
k_1	0.1969	0.1002	0.1070	0.1484	0.1054

At pH 5.5 using active sevelamer HCl as binding agent the affinity constant (K_1) and binding capacity constant ($K_{2)}$ values were also determined by plotting unbound phosphate concentration (mM) / binding capacity (mM/gm) versus unbound phosphate concentration (mM) at this pH (Table 19). The RSQ value, slope and intercept of the regressed plot were determined and the K_1 and K_2 values were obtained from these values respectively for samples respectively.

The combined Langmuir plot of unbound phosphate verses unbound phosphate/binding capacity at pH 5.5 of Sevelamer HCl (API), Renagel 400 mg tablet, Sevel B 3001 400 mg tablet, Sevel B 3002 400 mg tablet and Sevel B 3003 400 mg tablet were shown in Fig. 6. The Langmuir affinity constant (K_1), binding capacity constant (K_2), RSQ, slope and intercept were very similar for all samples at this pH as shown in Table 3.

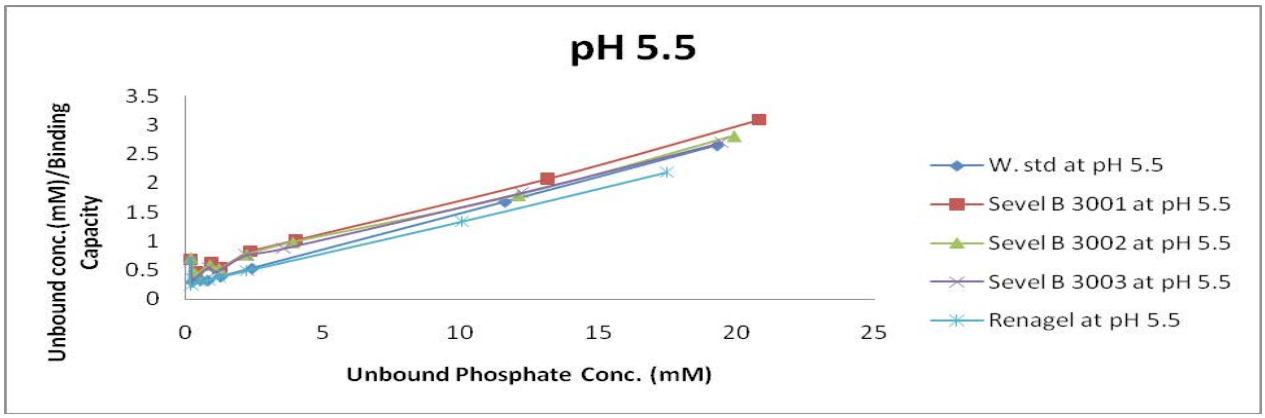

Fig. 6. Langmuir plot of working standard (Sevelamer HCl), Renagel 400 mg, Sevel 400 (B 3001), Sevel 400 (B 3002), and Sevel 400 (B 3003) at pH 5.5

Table 3. The Langmuir capacity and affinity constants calculated at pH 5.5

	Sevelamer API	Renagel 400	Sevel 400 (B 3001)	Sevel 400 (B 3002)	Sevel 400 (B 3003)
RSQ	0.974	0.962	0.991	0.985	0.983
Slope	0.119	0.106	0.123	0.114	0.114
Intercept	0.317	0.300	0.500	0.494	0.449
k_2	8.371	9.393	8.111	8.739	8.711
k_1	0.375	0.354	0.246	0.232	0.255

At pH 7.0 using active sevelamer HCl as binding agent the affinity constant (K_1) and binding capacity constant ($K_{2)}$ values were also determined by plotting unbound phosphate concentration (mM) / binding capacity (mM/gm) versus unbound phosphate concentration (mM) at this pH (Table 21). The RSQ value, slope and intercept of the regressed plot were determined and the K_1 and K_2 values were obtained from these values respectively for samples respectively.

The combined Langmuir plot of unbound phosphate verses unbound phosphate/binding capacity at pH 7.0 of Sevelamer HCl (API), Renagel 400 mg tablet, Sevel 400 mg tablet (B 3001), Sevel 400 mg tablet (B 3002) and Sevel 400 mg tablet B 3003 were shown in Fig. 7. The Langmuir affinity constant (K_1), binding capacity constant (K_2), RSQ, slope and intercept were very similar for all samples at this pH as shown in Table 4.

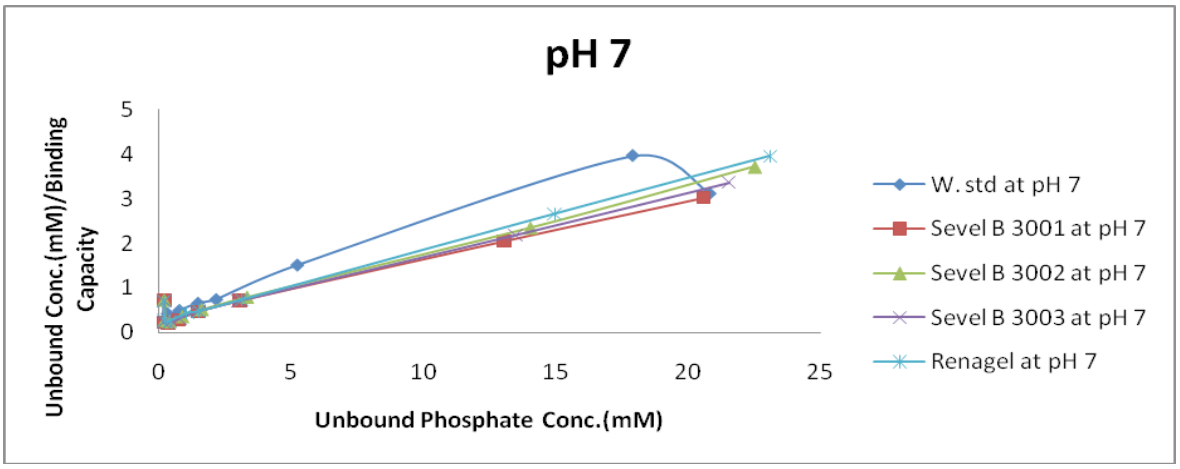

Fig. 7. Langmuir plot of working standard (Sevelamer HCl), Renagel 400 mg, Sevel B 3001, Sevel B 3002, and Sevel B 3003 at pH 7

Table 4. The Langmuir capacity and affinity constants of all sample calculated at pH 7.0

	Sevelamer API	Renagel 400mg	Sevel B 3001	Sevel B 3002	Sevel B 3003
RSQ	0.924	0.987	0.9722	0.9827	0.9794
Slope	0.154	0.156	0.1322	0.1486	0.1408
Intercept	0.502	0.314	0.3096	0.3212	0.2973
k_2	6.462	6.385	7.5635	6.7269	7.0992
k_1	0.307	0.497	0.4270	0.4627	0.4736

At each individual pH, sevelamer hydrochloride powder (working std.), Sevel 400 mg (B 3001), Sevel 400 mg (B 3002), Sevel 400 mg (B 3003) tablet, Renagel 400 mg tablet exhibited very similar binding properties. The affinity constant (K_1) of all samples increased gradually form pH 4.0 to 7.0.

Discussion

The in-vitro equivalence study of Sevel 400 mg tablet was compared with reference brand product Renagel 400 mg tablet by maintaining GIT condition by the help of Langmuir approximation approved by FDA.[6] This study was performed to evaluate the efficacy of the generic drug Sevel 400 mg tablet with the innovator product Renagel 400 mg tablet.

The non-linearity of the Langmuir plot and the order of magnitude decrease in the affinity constants (K_1) at pH 4.0 can be explained by examining the fraction of each phosphate ion present as a function of pH in dilute solution. This is accomplished by taking into account the hydronium ion concentration at each pH, the pKa of each phosphate ion and the equilibrium reaction.[6] At pH range of approximately 6 - 8, monobasic phosphate is in equilibrium with dibasic phosphate. It has been demonstrated that

dibasic phosphate is predominately bound species at pH 7.0. [8]

At pH 5.5-6.0, the fraction of the monobasic ion increases. The small decreases in the binding affinity constant (K_1) demonstrates that the the binding force are weaker at pH 5.5 - 6.0. This is due to the decrease in the amount of dibasic phosphate bound and increase in the amount of the monobasic bound. At pH 4.0, the monobasic phosphate ion is predominately present.The affinity constants (K_1) are an order of magnitude lower at pH 4.0 than the affinity constants (K_1) at pH 7.0. These results suggest that the monobasic ion, which has only one site for binding, is more weakly bound than the dibasic ion, which has two sites for binding.[6]

The linearity of the Langmuir plots indicates mono-molecular binding. The relative non-linearity of the Langmuir plots at pH 4.0 may indicate non-monomolecular binding as a result of monobasic ion. The dibasic binding of phosphate at pH 7.0 and 5.5 of the test and reference were observed where the monobasic binding of phosphate was observed only at pH 4.0. The lower slope of the curve at pH 4.0 also demonstrates the lower binding affinity of monobasic ion.

A possible explanation for the similarities of the Langmuir plot at pH 7.0 and 5.5 is the apparent pKa values. The fraction of each ion at various pH in dilute solution with only phosphoric acid present in water. Sevelamer hydrochloride has an internal charge and hence its own internal ionic strength due to the amines, which are present. This intermolecular charge of sevelamer hydrochloride may shift the pKa of the dibasic anion from 7.2 to a slightly lower value when in solution and in contact with sevelamer hydrochloride. This would cause the fraction of the dibasic ion, at pH 5.5, to be substantially more than predicted.[6]

It shows a preference for phosphate over other intestinal anions, such as chloride and bicarbonate. The preference for phosphate is believed to be due to its dianion character, and may also involve hydrogen bonding. The absorption of phosphate in vitro is rapid (less than a minute) relative to the time of passage of such a drug through the small intestine (hours). It has also been found to prevent the absorption of dietary phosphate in vivo and in humans. [8]

Conclusion

Sevelamer hydrochloride (polyallylamine crosslinked with epichlorohydrin) is a polymeric hydrogel that has been developed as an oral pharmaceutical to prevent the absorption of dietary phosphate by kidney dialysis patients. It has been found to bind to phosphate in vitro, and to do so more effectively than a wide range of other cationic polymers. The results demonstrates that at each individual pH, Sevelamer hydrochloride (API), different batches of Sevel 400 mg tablets and

Renagel 400 mg tablet exhibited very similar binding properties showing equivalent kinetic properties in-vitro. So, it is evident that a good efficacy of generic drug Sevel 400 mg tablets manufactured by ACME Laboratories Ltd, Dhaka, Bangladesh was observed in terms of its Langmuir binding capacity constants (K_2) and affinity constants (K_1) as compared to innovator drug Renagel 400 mg tablets. So, Renagel 400 mg tablet manufactured by Genzyme Corporation, Ireland, UK can be substituted by generic product Sevel 400 mg tablet manufactured by ACME Laboratories Ltd, Dhaka, Bangladesh.

Acknowledgement:

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VITAMIN D AND OUR HEALTH: WHY SHOULD WE CARE?

Kazi M Anam, M.S.,R.Ph., FASCP, ND, CH,

In the 16th century, Galileo first theorized that the center of the universe was the sun and that all of the In the 16th century, Galileo first theorized that the center of the universe was the sun and that all of the planets, including Earth, orbited around it. Galileo was persecuted for his ideas and spent the last few years of his life under house arrest.

It seems that whenever there is a paradigm shift in thoughts, the current establishment almost always vehemently opposes the change for as long as possible. In science and medicine, in particular, research findings point to new changes or developments that have the potential to greatly benefit society. Regardless, such findings are often met with resistance. For decades, the medical community did not pay attention to the mounting evidence of the benefits of Vitamin D, beyond its association with bone formation and rickets.

The good news is that healthcare practitioners are now acknowledging the importance of Vitamin D and 25-hydroxy Vitamin D is now being widely tested for throughout the United States. What we know now about Vitamin D is astounding. It is now proven beyond doubt that Vitamin D, which functions more like a steroid hormone, can modify over 2000 genes in human body.

It is commonly accepted that humans contain somewhere between 25,000 to 30,000 genes. As such, Vitamin D has the potential to modify over 10% of our genes. There are profound benefits utilizing this knowledge to our advantage. New research conclusively demonstrates the role of Vitamin D in the prevention and treatment of many types of cancer. It is now estimated that in the United States, about 200,000 to 300,000 cancer patients die due to Vitamin D deficiency; worldwide, the death toll is two to three million annually. Vitamin D plays a key role in the prevention of at least 16 different types of cancer including breast, colorectal, lung, ovarian, pancreatic, and prostate cancer. It is estimated that about 600,000 of these cancer cases could be prevented if Vitamin D level is kept at its optimum range of 50 -65 ng/ml. Overall, optimal Vitamin D level can cut cancer risk by as much as 60 percent according to one large-scale, randomized placebo controlled study.

In addition to cancer, Vitamin D deficiency is associated with many autoimmune diseases and other health conditions:

- Alzheimer's
- Asthma
- Rheumatoid Arthritis
- Crohn's disease
- Cystic Fibrosis
- Depression
- Diabetes
- Infertility
- Heart disease
- Hearing Loss
- Multiple sclerosis
- Skin Conditions (Eczema, Psoriasis)
- Tuberculosis
- Muscle pain
- Macular degeneration
- Myopia
- Obesity
- Osteomalacia
- Preeclampsia
- Rickets
- Seizures

So how does Vitamin D work? Researchers discovered that Vitamin D is helpful in combating cancer because it increases apoptosis of cancer cells (programmed cell death) and differentiation. At the same time, Vitamin D lowers cell proliferation, invasiveness and angiogenesis (new blood vessel formation by cancer cells in the tumor). It can also be used as an antibiotic in acute upper respiratory viral conditions and for the flu. Vitamin D is also able to induce antimicrobial peptide gene expres-

sion, which boosts the immune system. It is recommended that pregnant women should optimize their Vitamin D level to prevent autoimmune disease development within offspring.

What is the normal blood level of 25-hydroxy Vitamin D? Controversy exists on this topic as well. At this time, the medical community accepts 25-hydroxy Vitamin D level of 20-40 ng/ml as normal. However, most researchers and physicians support the following breakdown:

- Deficient: < 40 ng/ml
- Optimal: 50-65 ng/ml
- Optimal for cancer treatment: 65-90 ng/ml
- Excessive: > 100 ng/ml

So how can we keep Vitamin D at the optimal level? You can obtain Vitamin D from the following: cod liver oil, mackerel, salmon, sardines, tuna, beef or calf liver, egg yolk, milk, mushroom, cheese, yogurt, etc. However, sun exposure is the easiest way to increase levels. In northeastern United States, there is limited sun exposure between the months of April and September. The best time to be outside is when the sun is about 50 degrees up from the horizon and your shadow is smaller your actual person. Dark-skinned individuals need as much as eight times more sunlight exposure than light-skinned individuals. However, caution must be exercised to avoid any type of sunburn. In the fall and winter months, supplementation with Vitamin D3 is recommended.

Here are Vitamin D3 supplementation guidelines:

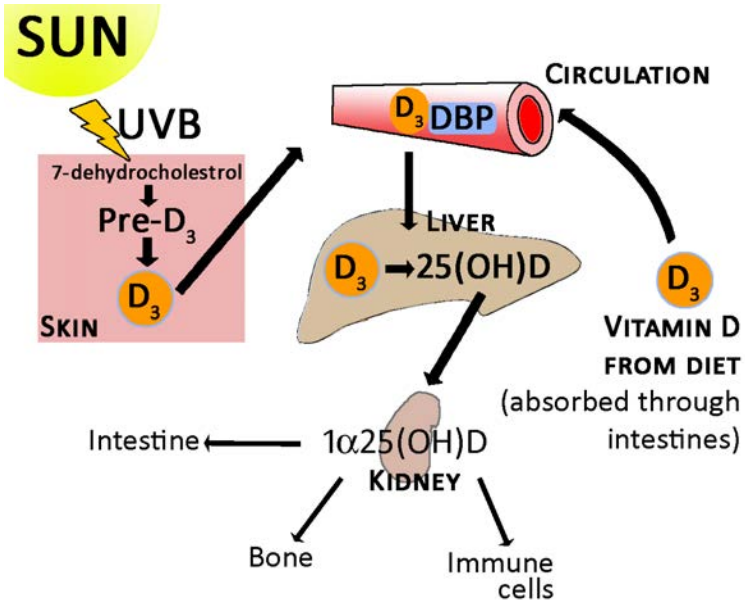
- No serious illness: Vitamin D3 3000 units daily for every 110 pounds.
- Cancer or autoimmune disease: Vitamin D3 5000 units daily for every 110 pounds.

Keep in mind that sun exposure can produce as much as 20,000 units of Vitamin D3, which takes about 3 to 4 days to be absorbed from the skin. Sunlight is composed of approximate 1500 wavelengths of rays and out of this, only 5% is UV-B which produces Vitamin D. It is available only a few hours of the day, when the sun is about 50 degrees from the horizon. Most individuals who expose themselves to the sun in the morning or in the afternoon are actually exposing themselves to the dangerous UV-A rays which can cause skin cancer.

It is now estimated that in the United States, about 200,000 to 300,000 cancer patients die due to Vitamin D deficiency; worldwide, the death toll is two to three million annually.

While supplementing with Vitamin D, it is important to monitor your levels so that it does not exceed 100 ng/ml. Symptoms of Vitamin D toxicity are as follows: nausea, vomiting, poor appetite, constipation, weakness, and weight loss. Furthermore, excess Vitamin D can increase the serum level of calcium, which can cause abnormal heart rhythms.

In conclusion, it is very important for people to pay attention to their 25-hydroxy Vitamin D levels and to actively work on maintaining optimum conditions through appropriate sun exposure, food choices, and Vitamin D3 supplements.



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REVIEW ON CHEMISTRY AND BIOACTIVITIES OF SECONDARY METABOLITES FROM SOME MEDICINAL PLANTS AND MICROBES OF BANGLADESH

Mohammad A. Rashid

Abstract

Plants and microorganisms, being the major source of many drugs, have attracted scientists from ancient times. However, until recently as insignificant percentage of the plants and some microorganisms have been investigated scientifically for their medicinal values. The present study was undertaken to discover new drug candidates from natural sources. Extensive chemical studies with 60 medicinal plants and several microbial strains of Bangladesh have resulted in the isolation and characterization of 150 compounds, including 50 new molecules. Terpenoids and alkaloids were the major constituents among the isolated constituents. The crude extractives and several purified molecules demonstrated statistically significant inhibition of growth of microorganisms, antioxidant, antidiabetic and HIV-inhibitory activities. Usnic acid, a lead compound isolated from the lichen, *Parmelia kamtschandalis*, showed potent antimicrobial activity, whereas dehydroaltenusin obtained from a *Streptomyces* sp. exhibited significant HIV-inhibitory effects.

Key words: Medicinal Plants, secondary metabolites, antioxidant, antidiabetic, HIV-inhibitory activity.

Introduction

Medicinal plants are the blessings for any country which contribute a lot for traditional health management as well as providing lead compounds for modern drug discovery. The varieties of molecules contained in plants have been proved to combat complicated diseases. Based on this, natural product scientists have always focused on the isolation of bioactive compounds from these precious herbs and trees. In addition, the giant pharmaceutical companies are also capitalizing these scopes for incorporating new drugs in the market (Burnett *et al.,* 2012; Christen and Cuendet, 2012; Hung *et al*., 2012; Lovkova *et al*., 2001; Newman and Cragg, 2012).

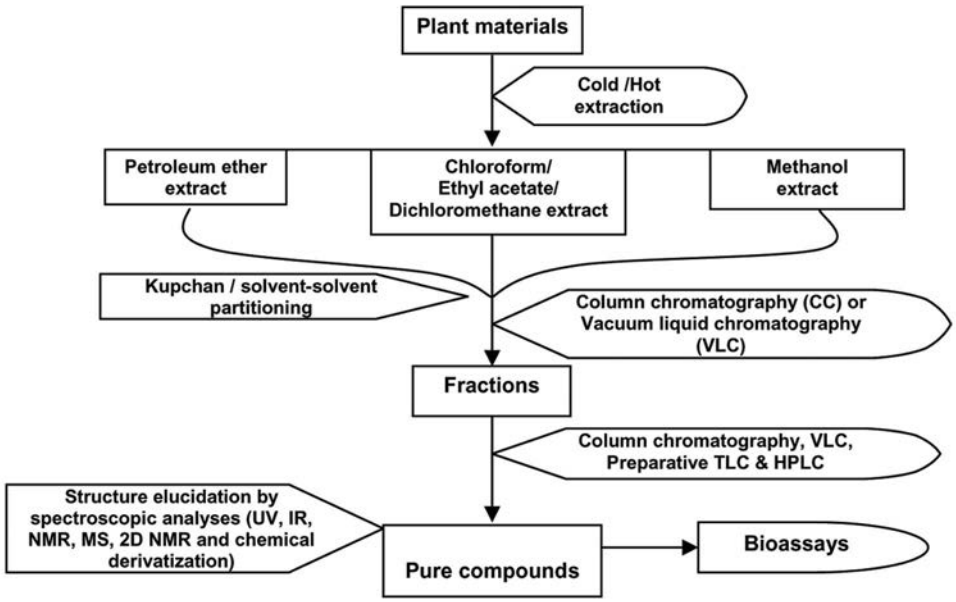
Bangladesh being a subtropical country is a good repository of plants. There are around 5000 angiosperms distributed among 200 families. Approximately, 500 of these are being used in the traditional medicines for the treatment of different types of diseases. A significant percentage of the population depends on the natural product based medicines. In addition, the total medicinal plant market of Bangladesh is equivalent to US$14 billion each year. As part of our continuing studies on plants here, we summarize the chemistry and bioactivities of some of the isolated constituents from 48 medicinal plants of Bangladesh (Ara *et al*., 2006; Begum *et al*., 2011; Islam *et al*., 2009; Jahan *et al*., 2009; Rahman *et al*., 2011).

Materials and Methods

Chemical: The chemical investigation of a plant involved collection and proper identification of the plant materials, extraction, fractionation and purification of compounds and structural characterization of the purified secondary metabolites. On the other hand, the culture filtrate of the microorganism's broth culture was extracted with ethyl acetate. Various chromatographic techniques (Zhu *et al*., 2003; Moustafa *et al*., 2007; Widodo *et al*., 2008; Jain and Bari, 2010) were utilized for isolation and purification of the compounds from the extractives. The structures of the purified compounds were determined by extensive analyses of UV, IR, NMR and mass spectroscopic data as well as by chemical derivatization, when needed. Whenever possible, the crude extracts, fractions and purified compounds were subjected to bioassays (e.g.

antimicrobial activity, antioxidant, antidiabetic, HIV inhibitory activities etc.) The whole process can be explained by scheme 1.

Antimicrobial activity: The antimicrobial activity of the purified compounds (Bhilabutra *et al*., 2007; Ahamed *et al*., 2007; Ghani *et al*., 2012) was determined by the disc diffusion method (Sunilson *et al*., 2009). The bacterial strains were collected as pure cultures from the Institute of Nutrition and Food Science (INFS), University of Dhaka, Bangladesh. The samples were dissolved separately in chloroform and applied to sterile discs at 100 or 30 µg/ disc and carefully dried to evaporate the residual solvent. Here, kanamycin, amoxicillin, streptomycin and tetracycline were used as standard antimicrobial agents.



Scheme 1. Isolation, purification and bioassays of compounds.

Antioxidant activity: The antioxidant (free radical scavenging) activity of the compounds was assessed by the method of Brand-Williams (Brand-Williams *et al*., 1995; Aher *et al*., 2009; Ham *et al*., 2010). Percentage inhibitions were plotted against respective concentrations used and from the graph obtained, the IC_{50} was calculated. Tert-butyl-1-hydroxytoluene (BHT), a potential antioxidant, was used as positive control.

Antidiabetic activity: Antidabetic activity was investigated on alloxan-induced Long Evan's rats following the procedure published elsewhere (Mansour *et al*., 2002). The rats (weighing 100-200 g) were obtained from the International Centre for Diarrheal Disease Research, Bangladesh (ICDDR,B), Dhaka. The experimental procedure has been shown shown in Table 1.

Anti-HIV assay: The purified compound was dissolved in DMSO, diluted to the desired concentration and tested in a XTT-based *in vitro* anti-HIV assay (Gulakowski *et al*., 1991).

Table 1. Design of experiment for antidiabetic study.

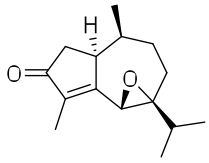
	Phase-1	Phase-2
Test materials	Methanol extract of whole plant	Eclalbasaponin II
Duration	4 weeks	1 week (due to lack of sample)
Group of rats		
Gr-1	Normal untreated	Normal untreated
Gr-2	Alloxan treated	Alloxan treated
Gr-3	Glibenclamide treated (600 µg/kg bw orally)	Glibenclamide treated (600 µg/kg bw orally)
Gr-4	Plant extract treated (300 mg/kg bw orally)	eclalbasaponin II treated orally (10 mg/kg bw orally)
Analysis		
Body weight	At weekly interval	After a week
Blood sugar	At weekly interval for 28 days	At two days interval for 7 days
Hepato-toxicity	ALT, AST and ALP at 28th day	Not done

Results

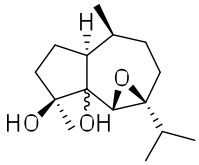
Chemical: Extensive chromatographic separation and purification of the extracts obtained from 48

medicinal plants of Bangladesh afforded a total of 150 pure chemical entities, including 37 new molecules (Rahman *et al*., 2001). The structures of these compounds were elucidated by extensive spectroscopic studies including 2D NMR and MS and chemical derivatization wherever needed. The structures of some of the isolated compounds are shown below:

Sesquiterpenes from *Amoora rohituka* Roxb. (Meliaceae) (Chowdhury *et al*., 2003)

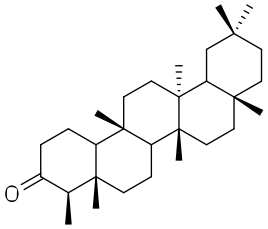


6β,7β-Epoxyguai-4-en-3-one

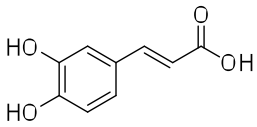


6β,7β-Epoxy-4β,5-dihydroxyguaiane

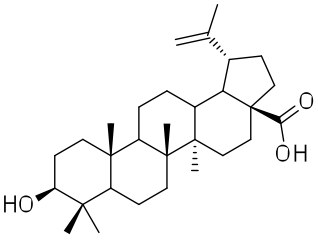
Triterpenes and phenylpropanoid from *Amoora cucullata* Roxb. (Meliaceae) (Rahman *et al*., 2005), *Corypha taliera* Roxb. (Palmae) (Chowdhury *et al*., 2013) and *Mesua nagassarium* Burm.f. (Clusiaceae) (Islam 2012)



Fridelin

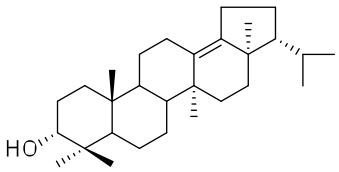


Caffeic acid

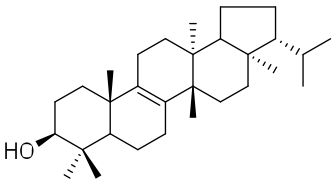


Betulinic acid

Terpenoids from *Melicope indica* Wt. (Rutaceae) (Farruque *et al*., 2003)

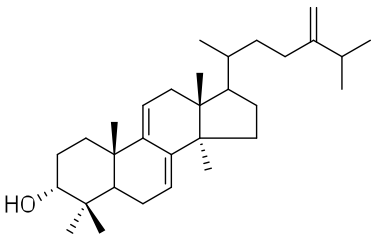


Neohop-13(18)-en-3α-ol

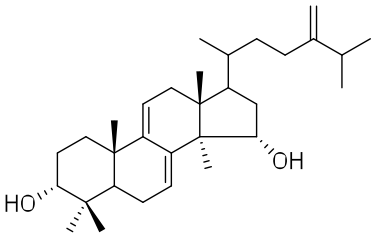


Fern-8(9)-en-3β-ol

Steroids from *Artabotrys odoratissimus* R.Br (Hasan *et al*., 1987) and B from *Desmos longiflorus* Roxb. (Connolly *et al*., 1994) (Annonaceae)

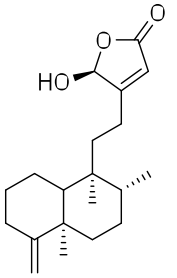


24-Methylene-lanosta-7,9(11)-dien-3β-ol (A)

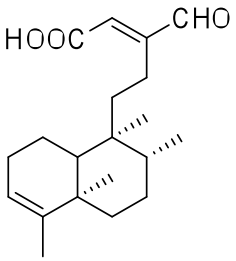


15α-Hydroxy-24-methylene-lanosta-7,9(11)-dien-3-ol (B)

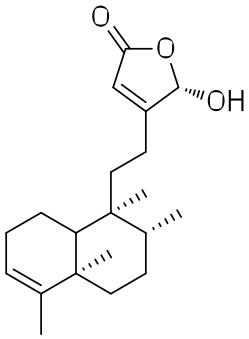
Diterpene from *Polyalthia longifolia* var. *pendulla* (Annonaceae) (Hasan *et al*., 1995)



16β-Hydroxykolava-4,3*Z*-dien-15,16-olide

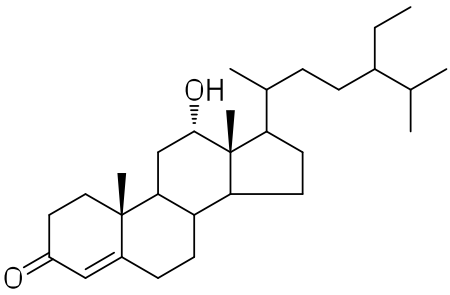


(-)-16-oxocleroda-3,13(14)*E*-dien-15-oic acid



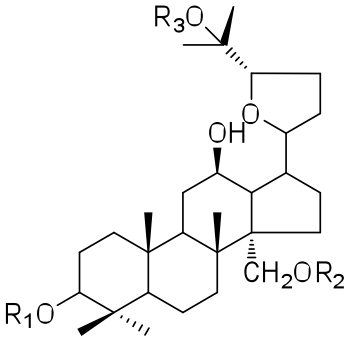
(-)-16α-hydroxycleroda-3,13 (14)*Z*-dien-15,16-olide

Steroid from *Toona ciliata* M. Roem (Meliaceae) (Chowdhury *et al*., 2003)



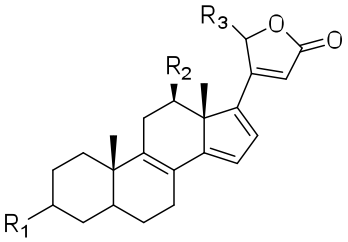
12α-Hydroxystigmast-4-en-3-one

Triterpene glycosides from *Corchorus capsualris* L. (Tiliaceae) (Hasan *et al*., 1984; Quader *et al*., 1987)

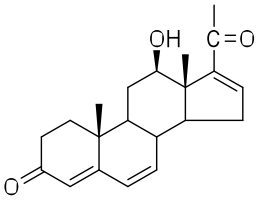


$R_1 = R_2 = R_3 = H$: Capsugenine
$R_1 = R_3 = H$, R_2= Glucose: Capsugenine-30-*O*-β-glucopyranoside
$R_1 = H$, $R_2 = R_3$= Glucose: Capsugenine-25, 30-*O*-β-glucopyranoside

Steroids from *Nerium oleander* L. (Apocynaceae) (Huq *et al*., 1999a; Huq *et al*., 1999b)

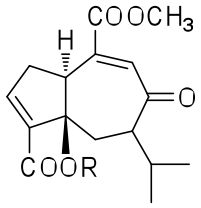


R_1= OH, R_2= R_3= H: 3-Hydroxy-5-carda-8,14,16,20(22)-tetraenolide
R_1= R_3= H, R_2 = OH: 12-Hydroxy-5-carda-8,14,16,20(22)-tetraenolide
R_1= glu, R_2= H, R_3= OH: 21-Hydroxy-5-carda-8,14,16,20(22)-tetraenolide-3-β-digitaloside



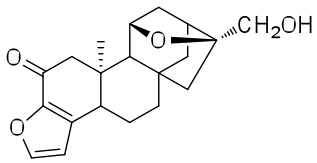
Neridienone A

Terpenoids from *Polygonum viscosum* Buch. (Polygonaceae) (Datta *et al*., 2002)



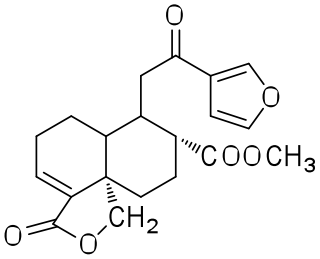
R = H: Viscoazusone; R = CH_3: Viscoazulone

Terpenoids from *Coffea bengalensis* Roxb. (Rubiaceae) (Hasan *et al*., 1995)

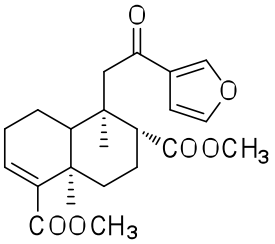


Bengalensol

Diterpenoids from *Barringtonia recemosa* L. (Lecythidaceae) (Hasan *et al*., 2000)

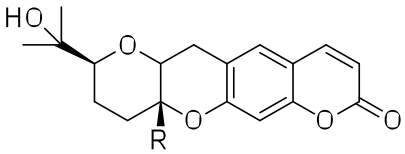


Nasimalun A



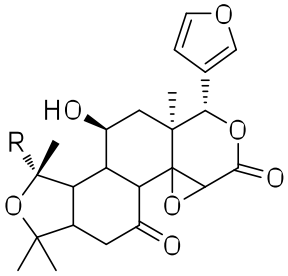
Nasimalun B

Coumarins and limonoids from *Clausena heptaphylla* Roxb. (Rutaceae) (Begum *et al.*, 2011; Sohrab *et al.*, 1999)

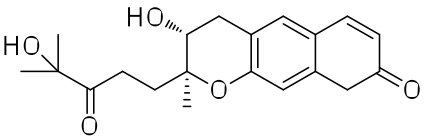


R = H: Lunamarin A;

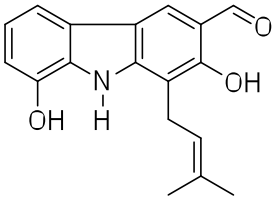
R = CH_3: Lunamarin B



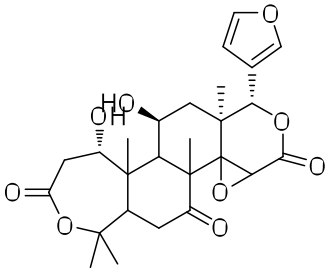
R = OMe: Clausenolide-1-methyl ether
R = OH: Clausenolide



Lunamarin C

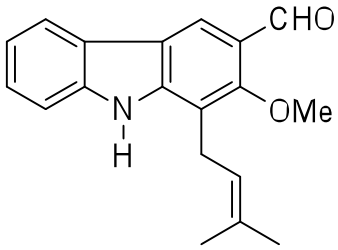


8-Hydroxyheptaphylline

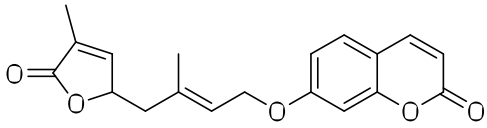


Clausenarin

Alkaloid and coumarins from *Clausena suffruticosa* Roxb. (Rutaceae) (Begum *et al.*, 2008)

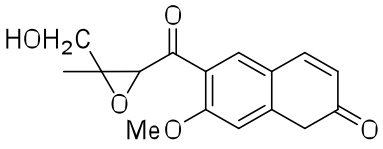


O-Methylheptaphylline

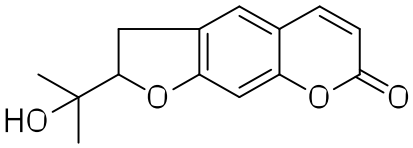


Capnolactone

Coumarins and flavonoid from *Micromelum minutum* G. Forster (Rutaceae) (Sohrab *et al.*, 2004)

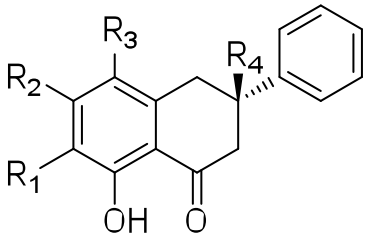


Hopeyhopol



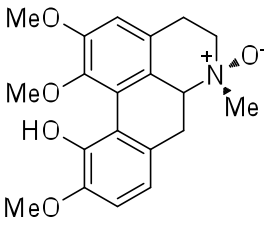
Marmesin

Flavonoids from *Unona discolor/Uvaria chinensis* Vahl. (Annonaceae) (Asha *et al.*, 2003)

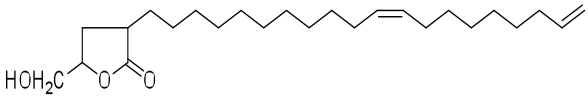


R_1 = CH_3, R_2 = H, R_3 = CHO, R_4 = H: 8-Formyl-6-methyl-5-hydroxyflavanone
R_1 = CH_3, R_2 = OH, R_3 = CHO, R_4 = OH: 8-Formyl-6-methyl-2β,5,7-trihydroxyflavanone
R_1 = CHO, R_2 = OH, R_3 = CH_3, R_4 = OH: 6-formyl-8-Methyl-2β,5,7-trihydroxyflavanone

Alkaloid and acetogenin from *Miliusa velutina* (Dunal) Hook. (Annonaceae)(Jumana *et al*., 2000a; Jumana *et al*., 2000b)

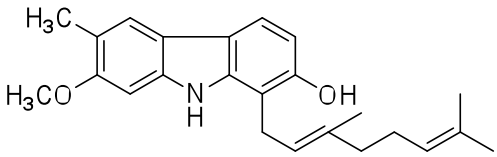


(+)-Isocorydine-α-N-oxide

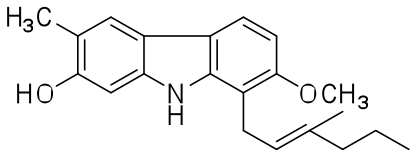


Isogoniothalamusin

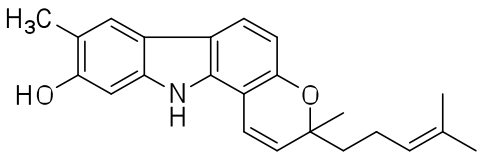
Coumarins from *Murraya koenigii* L. (Rutaceae) (Nutun *et al*., 1999)



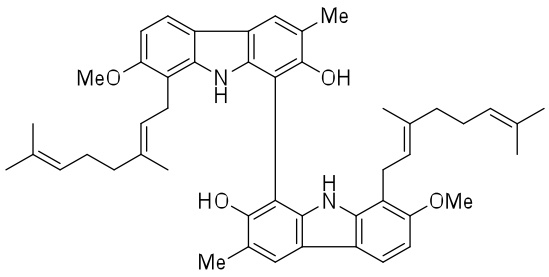
Murrayanol



Isomurrayanol

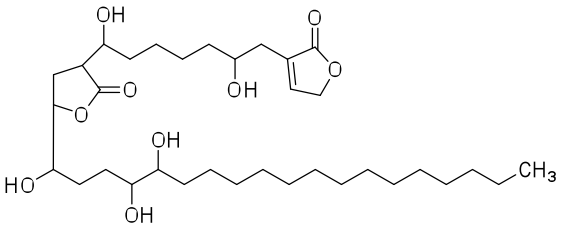


Isomahanime

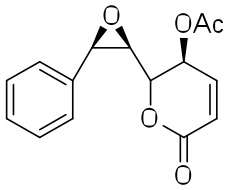


Bismurrayafoline E

Styryl lactone from *Goniothalamus sesquipedalis* Wall. (Annonaceae) (Hasan *et al*., 1994; Hasan *et al*., 1996)

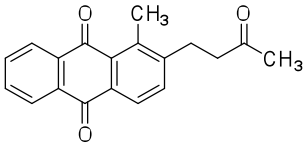


Gigantopentocin

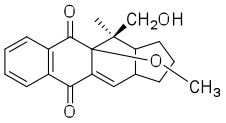


5-Acetoxy isogoniothlamineoxide

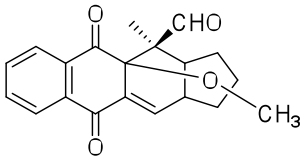
Anthraquinones and napthaquinones from *Stereospermum chelonoides* (L.f.) DC (Bignoniaceae) (Haque *et al*., 2006)



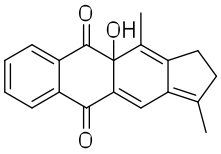
Stereochenol A



Stereochenol B

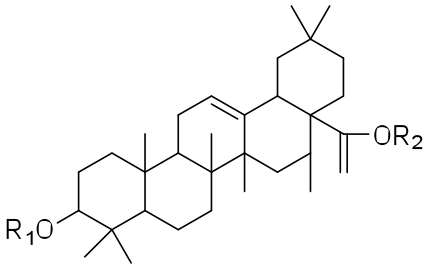


Sterekunthal B



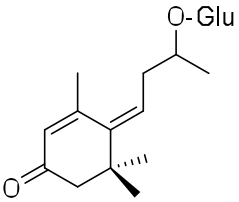
Sterequinone C

Saponins from *Eclipta prostrata* L. (Asteraceae) (Rahman *et al*., 2006; Rahman and Rashid, 2008)

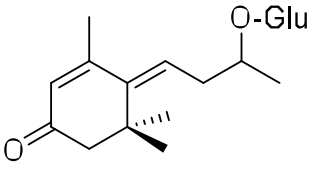


R_1 = β-D-glucose, R_2 = H: Eclalbasaponin I; R_1 = R_2 = β-D-glucose; Eclalbasaponin II

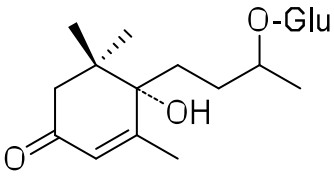
Glycosides from *Pterospermum semisagittatum* Buch. (Sterculiaceae) (Khan *et al.*, 2003)



(*Z*)-4-[3′-(β-D-Glucopyranosyloxy)-butyli-dene]-3,5,5-trimethyl-2-cyclohexen-1-one

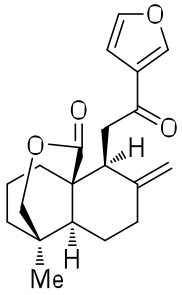


(*E*)-4-[3′-(β-D-Glucopyranosy-loxy)-butyli-dene]-3,5,5-trimethyl-2-cyclohexen-1-one



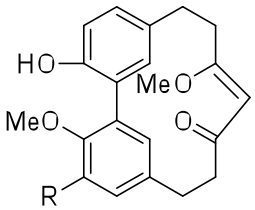
(*E*)-4-Hydroxy-4-[3′-(β-D-glucopyranosyloxy)-butylidene]-3,5,5-trimethyl-2-cyclohexen-1-one

Diterpenoid from *Potamogeton nodosus* Poir. (Potamogetonaceae) (Qais *et al.*, 1998)



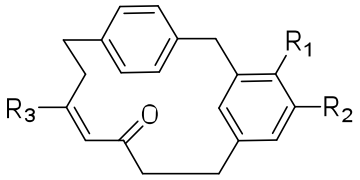
15,16-Epoxy-12-oxo-8(17),13(16),14-labdatrien-20,19-olide

Diarylheptanoids from *Garuga pinnata* Roxb. (Burseraceae) (Ara *et al.*, 2006)



R = OH: 6'-Hydroxygaruganin V

R = H: Garuganin V



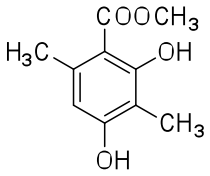
R_1 = H, R_2 = R_3 = OMe: Garuganin IV

R_1 = OMe, R_2 = H, R_3 = OH: 9'-Desmethylgarugamblin-I

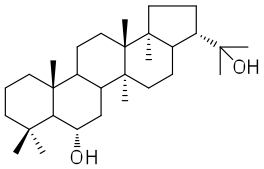
R_1 = R_2 = R_3 = OMe: Garuganin III

R_1 = OH, R_2 = R_3 = OMe: 1-Desmethylgaruganin III

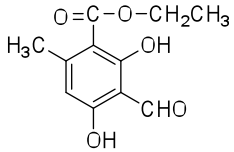
Triterpene and phenolics from *Parmelia kamtschandlis* Ach. (Parmeliaceae) (Mazid *et al.*, 2001)



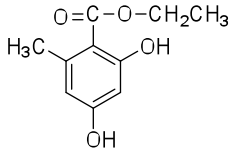
Methyl ß–orsellinate



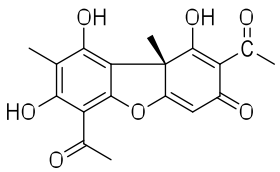
Hopane-6α,22-diol



Ethyl haemmatommate

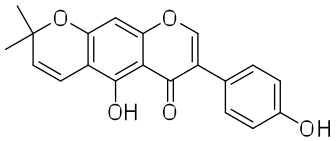


Ethyl (6-methyl-2,4-dihydroxy)-6-benzoate

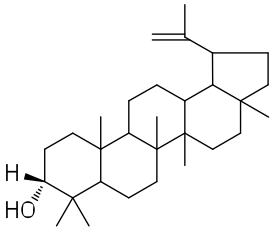


Usnic acid

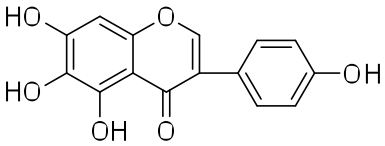
Flavonoids and triterpene from *Erythrina variegata* L. (Fabaceae) (Rahman *et al.*, 2007)



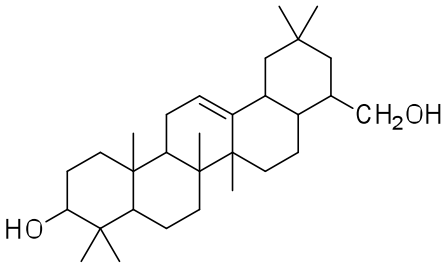
Alpinum isoflavone



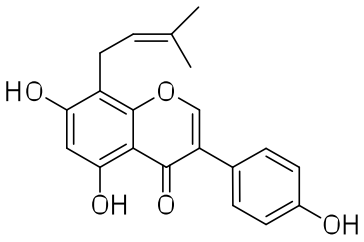
Epilupeol



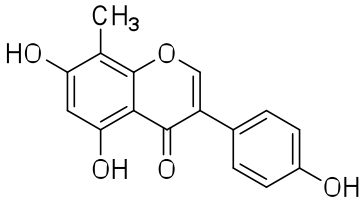
6-Hydroxygenistein



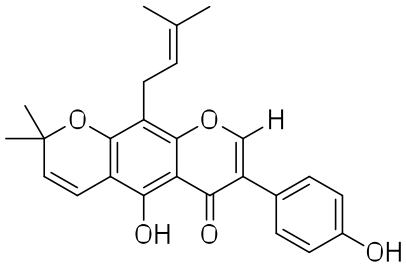
3β,28-Dihydroxyolean-12-ene



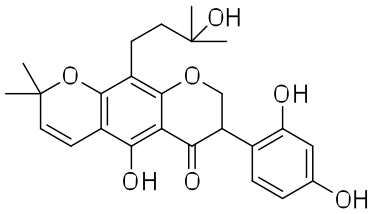
4′,5,7-Trihydroxy-8-prenylisoflavones



4′,5,7-Trihydroxy-8-methylisoflavone

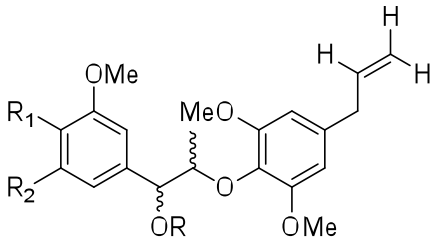


Scandenone



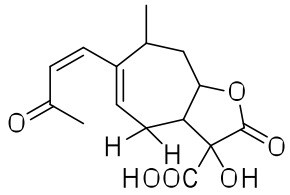
2′,4′,5-Trihydroxyl-8- (3-methylbut-1(*Z*)enyl)-2″,2″-dimethylpyrano [5″,6″:6,7] isoflavanone

Neolignans from *Quisqualis indica* L. (Combretaceae) (Jahan *et al.*, 2009)

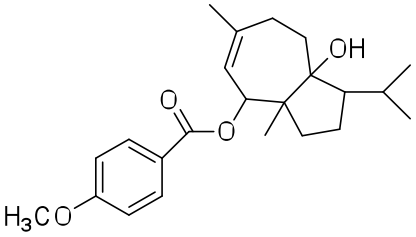


R = R_2 = H, R_1 = OH:
1-(4-Hydroxy-3-methoxyphenyl)-2-(4-allyl-2,6-dimethoxyphenoxy)-propan-1-ol
R = R_2 = H, R_1 = OMe:
1-(3,4-Dimethoxyphenyl)-2-(4-allyl-2,6-dimethoxyphenoxy)-propan-1-ol
R = $COCH_3$, R_1 = OMe, R_2 = H:
1-(3,4-dimethoxyphenyl)-2-(4-allyl-2,6-dimethoxyphenoxy)-propan-1-ylacetate
R = H, R_1 = OH, R_2 = OMe:
1-(4-Hydroxy-3,5-dimethoxyphenyl)-2-(4-allyl-2,6-dimethoxyphenoxy)-propan-1-ol

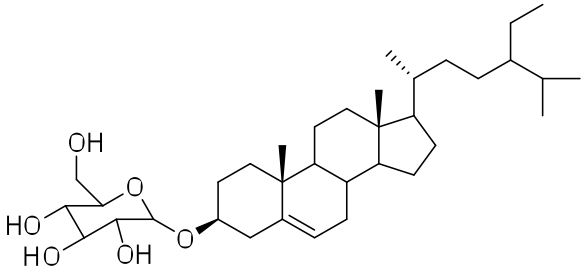
Terpenoids *Xanthium strumarium* L. (Compositae) (Islam *et al.*, 2009)



11-Hydroxy-11-carboxy-4-oxo-1(5), 2(*Z*)-xanthadien-12, 8-olide

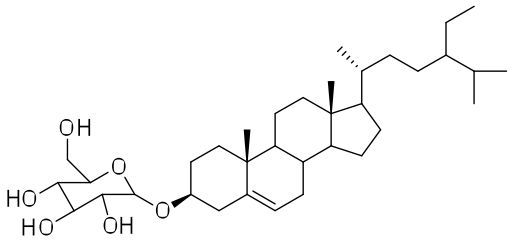


Lasidiol-10-anisate

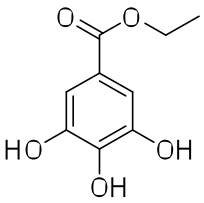


Daucosterol

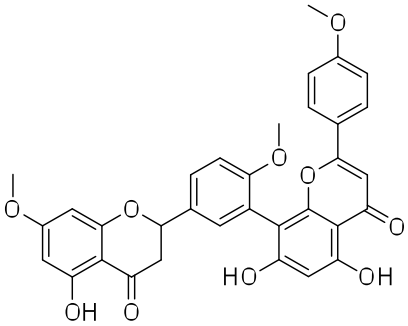
Polyphenolics from *Podocarpus neriifolius* D. (Podocarpaceae) (Rumzhum, 2008)



Daucosterol

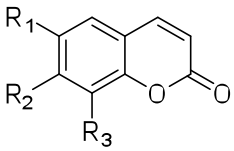


Ethyl gallate



Amentoflavone-4´,4´´´,7- trimethyl ether

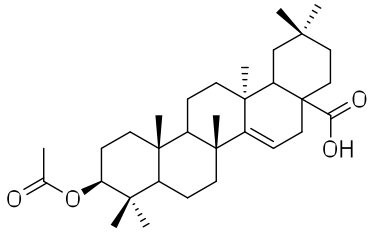
Terpenoids and coumarins from *Jatropha podagrica* Hook. (Euphorbiaceae) (Rumzhum *et al.*, 2011)



$R_1 = R_2 = COH_3$, R_3 = OH : Fraxidin

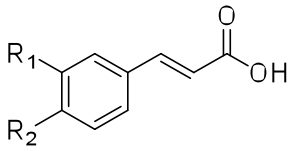
$R_1 = COH_3$, $R_2 = R_3$ = OH : Fraxetin

$R_1 = R_2 = COH_3$, R_3 = H : Scoparone



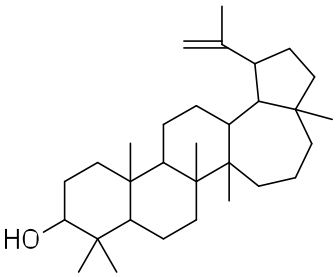
Acetylaleuritolic acid

Phenylpropanoid and triterpene from *Albizzia lebbeck* L. (Leguminosae) (Hussain *et al.*, 2008), *Corypha taliera* Roxb (Palmae) (Chowdhury *et al.*, 2013), *Albizia chinensis* (Osbeck.) Merr. (Fabaceae) (Sharmin *et al.*, 2013) and *Mesua nagassarium* Burm.f. (Clusiaceae) (Islam, 2012)



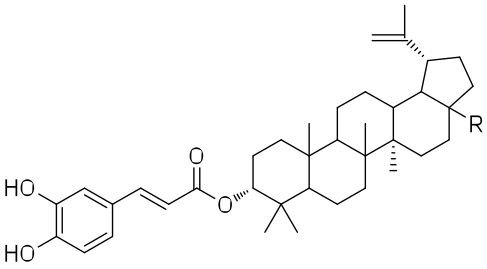
$R_1 = COH_3$, R_2 = OH: Methoxycinnamic acid

R_1 = H, R_2 = OH: Trans-*p*-coumaric acid



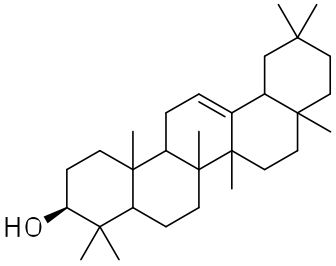
Lupeol

Triterpenes from *Couroupita guianensis* Aubl. (Lecythidaceae), *Corypha taliera* Roxb (Palmae) (Chowdhury *et al.*, 2013), *Bryophyllum daigremontianum* Raym. (Crassulaceae) (Sharker *et al.*, 2013) (Begum *et al.*, 2009) and *Glycosmis pentaphylla* (Rutaceae) (Ahmed, 2013)



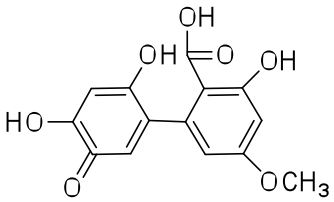
R=CH_2OH : Betulin-3β-caffeate

R=CH_3 : Lupeol-3β-caffeate

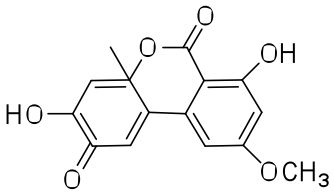


β-Amyrin

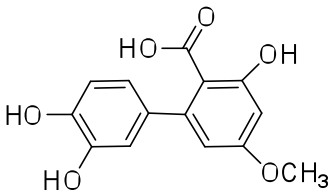
Unusual phenolic compounds from *Streptomyces* sp. (Jabbar *et al*., 1998)



Dehyroaltenusinic acid

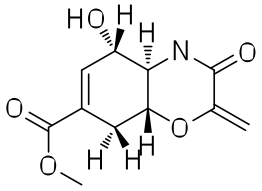


Dehyroaltenusin

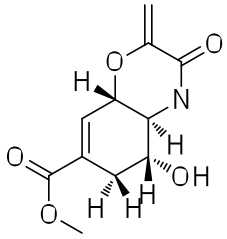


Altenusin

Secondary metabolite from *Monocillium* sp. (Biswas *et al*., 2000)

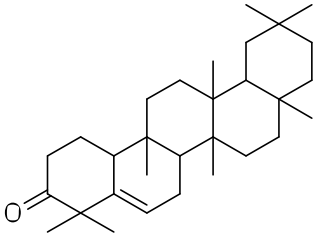


Monocillinol A

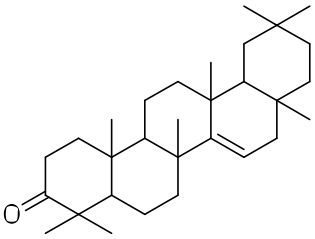


Monocillinol B

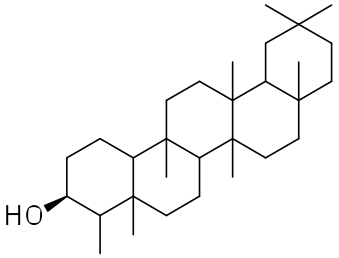
Triterpenes and flavonoid from *Kalanchoe pinnata (Lam.)* (Crassulaceae) (Sharker *et al*., 2012), *Corypha taliera* Roxb (Palmae) (Chowdhury *et al*., 2013), *Syzygium cumini* L. (Murtaceae) (sikder *et al*., 2012) and *Mesua nagassarium* Burm.f. (Clusiaceae) (Islam, 2012)



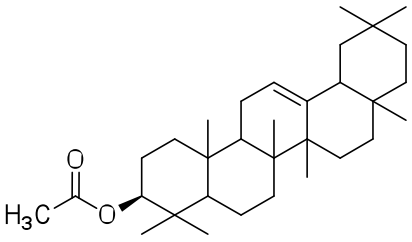
Glut-5(6)-en-3-one



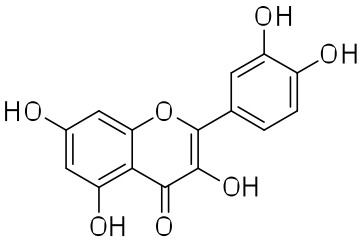
Taraxerone



β-Friedelanol

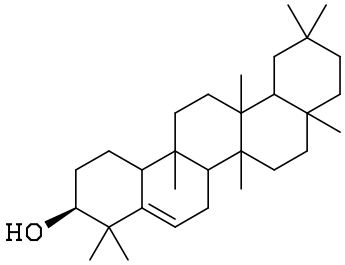


β-Amyrin-3-acetate

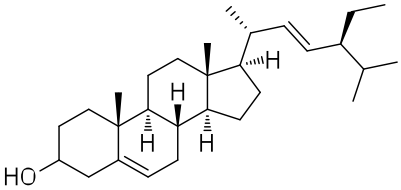


3,5,7,3',5'-Pentahydroxyflavone

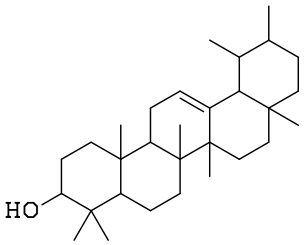
Triterpenes from *Bryophyllum daigremontianum* (Raym.) (Crassulaceae) (Sharker *et al*., 2013), *Corypha taliera* Roxb (Palmae) (Chowdhury *et al*., 2013) and *Albizia chinensis* (Osbeck.) Merr. (Fabaceae) (Sharmin *et al*., 2013)



Glut-5(6)-en-3β-ol

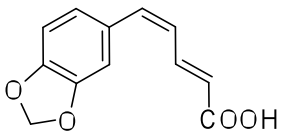


Stigmasterol

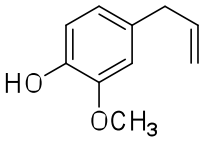


α-Amyrin

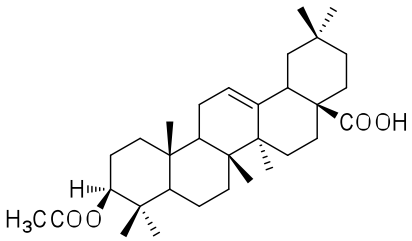
Secondary metabolites from *Melocanna baccifera* Roxb. (Kuddus *et al*., 2011)



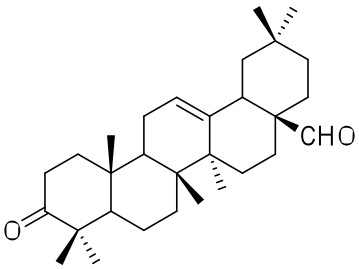
Isochavicinic acid



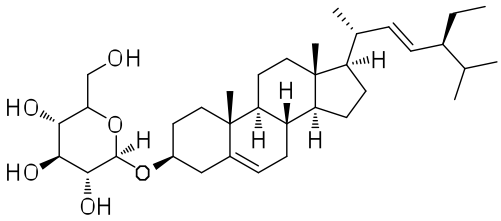
Eugenol



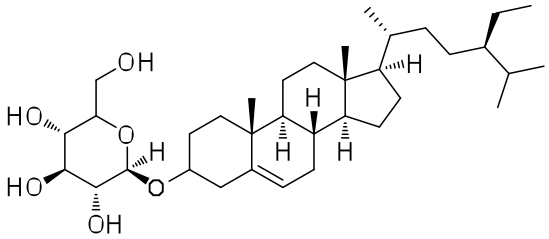
Olean-12-en-28-carboxy-3β-acetate



3-Oxo-olean-12-en-28-al

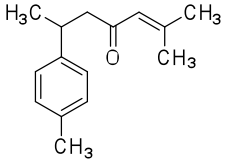


Stigmasterol glucoside

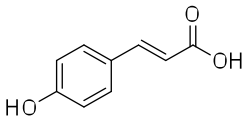


β-Sitosterol glucoside

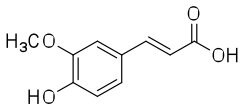
Sesquiterpene and phenylpropanoids from *Curcuma longa* L. (Zingiberaceae) (Kuddus *et al*., 2010) and *Syzygium cumini* L. (Murtaceae) (Sikder *et al*., 2012)



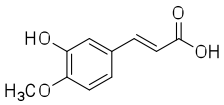
Turmerone



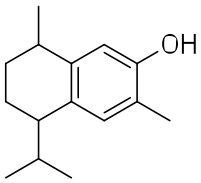
Trans-p-coumaric acid



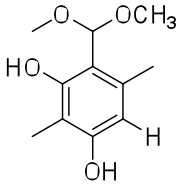
Trans-ferulic acid



Trans-isoferulic acid

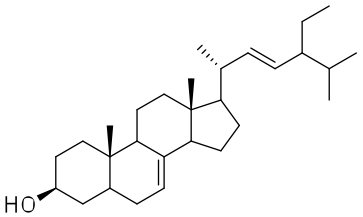


7-Hydroxycalamenene

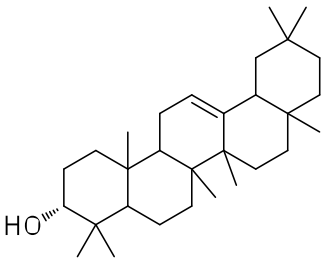


Methyl-β-orsellinate

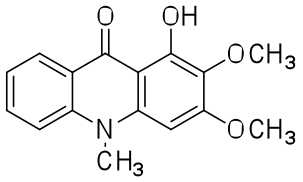
Acridone-type alkaloid and triterpene from *Glycosmis pentaphylla* Retz. (Rutaceae) (Ahmed, 2013) and *Mesua nagassarium* Burm.f. (Clusiaceae) (Islam, 2012)



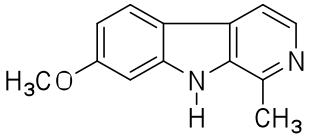
Spinasterol



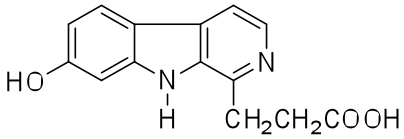
Epi-oleanolic acid



Arborinine

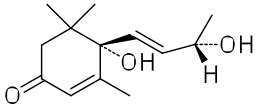


1-Methyl-7-methoxy-β-carboline

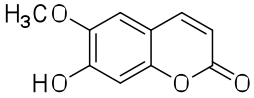


7-Hydroxy-beta carboline-1-propionic acid

Constituents from *Ophiorrhiza mungos* Linn. (Rubiaceae) (Islam, 2010)



Vomifoliol



Scopoletin.

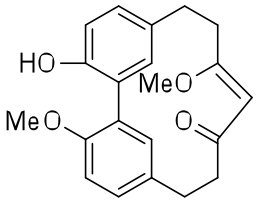
Biological: The crude plant extracts and purified compounds were subjected to screening for antimicrobial, antioxidant, anti-diabetic and anti-HIV activities. The results of some of the assays are summarized in the following tables:

Biological:

i) Antimicrobial activity:

Table 2. Antimicrobial activity of Garuganin V from *Garuga pinnata* at 100 µg/disc (Ara *et al.*, 2012).

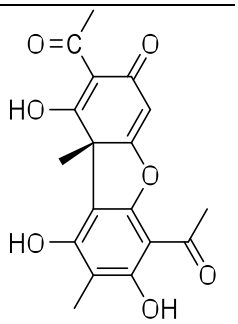
Microbes	Diameter of zone of inhibition (mm)		Structure (sample)
	Garuganin V	Kanamycin	
Gram positive bacteria			
Bacillus cereus	40	21	
Staphylococcus aureus	35	23	
Gram negative bacteria			
Escherichia coli	32	23	
Vibrio mimicus	36	21	
Fungus			
Aspergillus niger	31	20	
Candida albicans	35	20	



Garuganin V

Table 3. Comparative antibacterial activity of usnic acid and standard antibiotics (Rashid *et al.*, 2001).

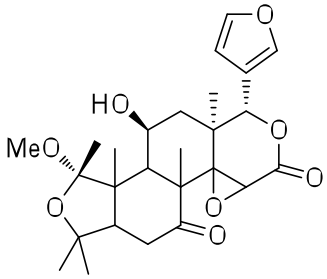
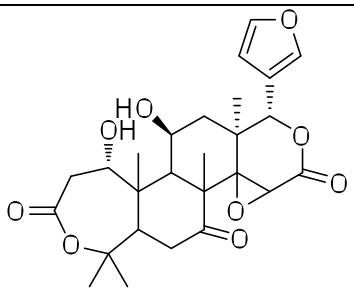
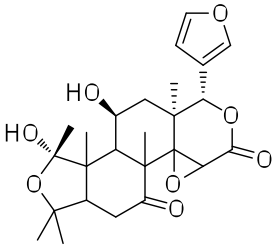
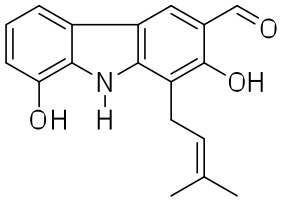
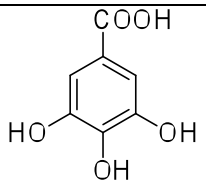
Microbes	Diameter of zone of inhibition (mm)				Structure (sample)
	Usnic acid	Amoxycillin	Streptomycin	Tetracycline	
	30 µg/ disc	10 µg/ disc	10 µg/ disc	30 µg/ disc	
Bacillus subtilis	23	33	26	34	
Escherichia coli	25	08	22	18	
Staphylococcus aureus	24	-	-	10	
Stap. epidermidis	23	39	12	24	



Usnic acid

ii) Antioxidant activity

Table 4. Free radical scavenging activity of some purified compounds (Begum *et al.*, 2009, 2011).

Structure	IC_{50} (µg/ml)	Structure	IC_{50} (µg/ml)
 Clausenolide-1- methyl ether	270	 Clausenarin	169
 Clausenolide	102	 8-Hydroxyheptaphylline	106
 Gallic acid (standard)	75		??

iii) Antidiabetic activity: The glucose level obtained in the blood of normal and experimental rats are given in table 5 for *E. prostrata* extract and in table 6 for eclalbasaponin II. The safety of the extractives in animal was evaluated by observing the effects of the extractives on liver enzymes. The levels of enzymes, alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) in plasma of normal and diabetic rats are depicted in table-8. The plant extract treated animals showed no significant changes of these enzyme levels as compared to the normal rats. This suggested that the extractives were safe in rat models. However, the levels of these enzymes were much lower than the diabetic control rats receiving no drugs.

The methanolic extract (300 mg/kg) showed a significant ($P<0.05$) blood glucose reduction (14.50%) on 7th day in diabetic rats as compared to the untreated diabetic rats (Table 6). Consequently, serum sugar reducing activity became significant ($P<0.001$) after 21 (43.18%) and 28 days (48.38%) of drug treatment. The purified compound, eclalbasaponin II (10 mg/kg) also reduced the serum sugar level (16.07%) significantly ($P<0.001$) after 3 days of treatment when compared with the untreated diabetic rats. The blood sugar lowering effects were increased after 5 (36.53%) and 7 days (52.90%) by eclalbasaponin II. In alloxan-induced diabetic rats the levels of plasma AST, ALT and ALP were significantly ($P<0.001$) increased by 93.48%, 64.30% and 81.44%, respectively relative to their normal levels in rats (Table 8). On the other hand, treatment of the diabetic rats with methanolic extract of the *E. prostrata* caused a reduction in the activity 43.74%, 37.97% and 48.09% of ALT, AST and ALP in blood plasma as compared to the mean values in the diabetic rats. It was also observed that there was no significant difference in the liver enzyme levels between the normal, glibenclamide and *E. prostrata*

treated rats. Therefore, the herb did not have any hepatotoxicity on rats (Rahman and Rashid, 2008). Similar hypoglycemic activity has been reported for glycoside D (β-D-galactopyranosyl) from *Calendula officinalis* (Fam.- Compositae) (Yoshikawa *et al*., 2001). Glycoside D and eclalbasaponin II are structurally related, both of which have been obtained from the member of the same family.

Table 5. Blood sugar levels in normal and alloxan - induced diabetic rats (Phase I) (Rahman *et al*., 2011).

Groups	mmol /l				
	1st day	7th day	14th day	21st day	28th day
Normal (untreated)	4.85±0.08	5.02±0.10	4.91±0.07	4.79±0.11	4.85±0.06
Diabetic control	12.03±0.18**	12.98±0.19**	14.05±0.23**	15.09±0.28**	17.20±0.22**
Glibenclamide Treated (1 mg/kg bw)	12.18±0.55	10.82±0.18	9.53±0.21	7.08±0.16	6.43±0.16
Methanolic extract Treated (300 mg/kg bw)	12.69±0.32	10.85±0.16*	9.37±0.20**	7.21±0.24**	6.55±0.11**

Values are given as mean ± SEM for 6 rats in each group. Diabetic control (Group-2) was compared with normal (Group-1) on corresponding day. Experimental group (Group-4) was compared with diabetic control group on corresponding day; *P<0.05 ; **P<0.001

Table 6. Blood sugar level in normal and alloxan - induced diabetic rats (Phase II) (Rahman *et al*., 2011).

Groups	mmol / L			
	1st day	3rd day	5th day	7th day
Normal untreated	4.8 ± 0.56	5.03 ± 0.48	4.85 ± 0.55	4.95 ± 0.40
Diabetic control	12.40 ± 0.35**	12.49 ± 0.44**	12.97 ± 0.51**	13.52 ± 0.34**
Glibenclamide treated (1 mg/kg bw)	12.78 ± 0.25	12.01 ± 0.31	11.63 ± 0.26	10.51 ± 0.35
Eclalbasaponin II treated (10 mg/kg bw)	12.87 ± 0.68	10.80 ± 0.71**	8.17 ± 0.65**	6.06 ± 0.66**

Values are given as mean ± SEM for 6 rats in each group. Diabetic control (Group-2) was compared with normal (Group-1) on corresponding day; Experimental group (Group-4) was compared with diabetic control group on corresponding day; *P<0.05; **P<0.001

Table 7. Percentage reduction of blood sugar level in alloxan induced diabetes rats.

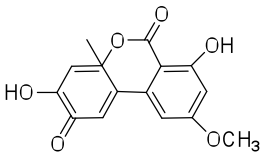
Day	% Reduction of blood sugar	Day	% Reduction of blood sugar
	Crude extract		Eclalbasaponin II
1	0.000	1	0.000
7	14.50	3	16.07
14	26.16	5	36.53
21	43.18	7	52.90
28	48.38	-	-

Table 8. ALT, AST and ALP levels of normal and alloxan-induced diabetic rats after 4 weeks.

Groups	U/L		
	ALT	AST	ALP
Normal untreated	28.34±0.88	166.66±2.15	60.16±3.39
Diabetic control	54.5±2.70**	273.83±3.37**	109.16±1.93**
Glibenclamide treated	31.83±2.77	196.16±3.51	58.83±3.26
Methanolic extract treated	30.66±1.33**	169.83±3.85**	56.66±3.84**

Values are given as mean ± SEM for 6 rats in each group. Diabetic control (Group-2) was compared with normal (Group-1). Experimental group (Group-4) was compared with diabetic control (Group-2). **P<0.001

Anti-HIV activity: The anti-HIV activity of dehydroaltenusin from *Streptomyces* sp. (Jabbar *et al*., 1999). Dehydroaltenusin revealed significant anti HIV activity (Figure 1).



Dehydroaltenusin

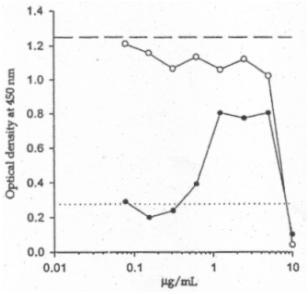


Figure 1. Graph showing the effects of dehydroaltenusin upon uninfected CEM-SS (o) and HIV-1 infected CEM-SS cells (•), as determinded after 6 days of culture. The higher optical density represents better anti HIV activity exhibited by the test compound

Conclusion

A total of 60 plant species have been investigated. Many structurally unique and diversified compounds having interesting biological activities were isolated from these plants. Our studies show that Bangladeshi plants and some microbial stains can be the promising sources of novel drug candidates.

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APHA-ASP 2014 ANNUAL MEETING: ORANGE COUNTY, FLORIDA

Sabrina Rahman, PharmD Candidate 2015 | St. John's University

During the last weekend of March 2014, I was fortunate enough to attend the Annual American Pharmacist Association-Academy of Student Pharmacists annual meeting and exposition. As secretary of the Phi Lambda Sigma Pharmacy Leadership Association of St. John's University, my executive board members and I were allowed a trip to the conference covered by the Dean's office. The Annual Meeting and exposition took place in Orange County Florida at the Marriott Convention Center. We arrived Thursday night and on Friday we were able to register for the annual meeting and exposition. Since the annual meeting for the student's starts off on Friday night with the Student Social we took the opportunity to visit the heart of Orlando. My classmates and I took a quick daytime visit to Orlando to Universal Studios where we had a great time on roller coaster rides and sightseeing. After arriving back to the Rosen Centre where we were staying, we were able to go to the "Neon Social" where all the different students from various pharmacy schools were having a meet and great. The event was sponsored by CVS pharmacy and it was also an opportunity for members running for the National board of AphA-ASP to run their campaign ideas. A lot of the presidents had their colleagues wearing their name and campaign slogan. It was a clever idea to get different names across.

Saturday was the day the big exposition kicked off. Over 150 different pharmaceutical companies and community pharmacies were present at the expo to give out information on residencies, jobs, new material, new opportunities, inventions that would further the pharmacy world, and free goods representing their campaigns. At the exposition I was fortunate enough to visit many different companies including my own CVS Pharmacy, as well as Walgreens, Wal-Mart, Safeway, Fargon pharmaceuticals, Pfizer, and many others. Currently working for CVS pharmacy I made sure to talk to the district managers and get ideas on how to further in the pharmacy field. It was a great chance to note my strengths and weaknesses which will hopefully help me in the future with landing a position as a pharmacist in the company.

At the exposition there were also opportunities to donate blood and participate in little lectures. One of the lectures from express scripts was on Linkedin which is one of the world's largest professional networks. This lecture was helpful because it gave tips on how to create a professional business profile and how important it is to be connected through a network to power your career. You are able to discover professional opportunities, business deals, and new ventures as well as obtain the latest news, insight, and inspiration. The exposition lasts until Sunday afternoon, so everyone takes the opportunity to try to make it on Saturday.

Around 1 pm there was the opening session for the Academy of Student Pharmacists. A "Broadway theme" was held this year, where the Chapter officers put on a kind of show, singing in between the award ceremonies. Over 20 different pharmacy schools were present including some

like St. John's University, Long Island University, Ohio State University of Pharmacy, University of Southern California School of Pharmacy, University of Florida College of Pharmacy, University of the Pacific Thomas J. Long School of Pharmacy and Health Sciences, and many more. The award ceremony included National Patient Care & Community Service Projects such as "Generation Rx", "Operation Diabetes", "Operation Heart", "Operation Immunization", and "Operation Self-Care". After the award ceremony, there was a very inspirational keynote speaker named Alex Sheen. Mr. Sheen's father was a pharmacist, who passed away from cancer. After this horrific situation Alex decided to make promise cards in his memory titled "because I said I would". He sent them all over to different people who would have to write a promise on this card and then fulfill it. He is a humanitarian that works in better the lives of others. He fulfilled many charitable promises like getting 100 tickets to Disneyland for children with cancer and walking 245 miles across the entire state of Ohio in 10 days to raise awareness for victims of violence and kidnapping of 3 women in Ohio. He now gives speeches on behalf of "because I said I would" in order to fund the work of the organization.

That afternoon after the opening ceremonies my executive board members and I were able to attend the Pharmacy Leadership Board of Delegates house. At this meeting we were able to participate in a few changes made to the amendment as well as elective the new national board members. After the conclusion of the PLS house of delegates, we were able to attend different continuing education credits. Sunday and Monday consisted of many attending different CE classes such as New Drugs of 2013, Hypertension Guideline updates, Diabetes updates, ADHD updates, and more. Overall we were able to meet different students from different colleges as well as brush up on some information from the CE classes. It was a great opportunity to join our colleagues in experiencing comprehensive programming, captivating speakers, and professional network opportunities. I was lucky enough to have the opportunity to have a taste of all the different types of sessions and event with so many of the students in pharmacy around the nation.

GLIMPSES FROM 2013 - 2014

The Concert Against Cancer, benefiting the V Foundation, was held on December 25th, 2013 at Club SANM in Astoria. Organized by Shantanu Alam and supported by BAPA, the event was a huge success with over $8,000 raised for cancer research. The highlight of the event was the Bengali Idol and Bengali Mom Top Chef competition. The Bengali Idol winner, Shomi Haque, did an original poetry slam that caused a huge ovation from the audience. As everyone was watching the talent onstage, they were also eating and judging the delicious dishes made by the contestants of the Top Chef competition. The Top Chef winner, Mita Chowdhury, produced a creative chicken dish that was spectacularly designed and tasted just as good. The high level of Bangladeshi-Americans' generosity, talent and cooking skills was fully showcased at this event, and BAPA takes great pride in supporting more of these events in the future.


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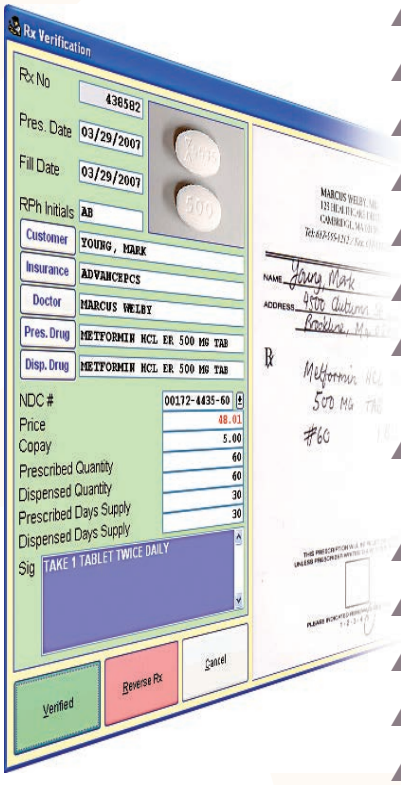

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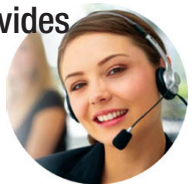

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