Use of Neem Leaf Powder as Natural Coagulant to Treat Industrial Wastewater

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Abstract **- Neem is one of the flexible trees with considerable ability to treat wastewater and its cultivation is extremely encouraged in most emerging countries. The leaves of this tropical tree consist of positively charged protein, solvable which performs as an effective coagulant. Treatment of wastewater costs excessive because of usage of chemical coagulants in treatment, hence nearly all village inhabitants go for an alternate to easily accessible supplies usually which is of minimal quality and disclosing them to waterborne infections. In this investigation work, tests were conducted to examine the several properties of neem leaf powder. This was done with varying dosages of 10, 20, 30, 40,50, and 60 g/L of neem leaf powder as a coagulant. Experiments were conducted without adding or addition of neem leaf powder. Also, the standards obtained from tests imply a low acidic value. The turbidity rate obtained indicated that tests with various dosages of neem leaf powder 10gm/L provide clear water along with a turbidity value of 91NTU. Jar apparatus testing was conducted to examine the optimum dosage of neem leaf powder, and also pH values imply an acidic range, for neem leaf. Results attained in this investigation provide the previous works suggesting the usage of neem leaf for wastewater treatment. Results achieved in this investigation assist in the earlier works carried out using neem leaf powder as a natural coagulant.**

Index Terms **- adsorbent, turbidity, hardness, chlorides, neem leaves.**

I.INTRODUCTION

From the olden day's usage of seeds, leaves, roots, barks, fruit peels, and vegetable peels obtained from the plant is carried out in the purification method. Natural coagulants reveal various benefits which comprise a reduction in collection of sludge, reduced cost, regulate variations in the pH of filtered water, non-poisonous, and ecosystem friendly. Researchers used numerous coagulants that have been examined consist of okra, nirmali plant, neem leaf, Moringa Oleifera, banana pith juice, hyacinth peel, tamarind powders have also carried out an investigational examination on the working of these different coagulants in filtering water.

In this present work, neem leaf powder is transformed into a resource of natural coagulant. Azadirachta indica, commonly known as neem, nimtree, or Indian lilac, the tree belongs to the mahogany family Meliaceae. It is one of two varieties in the species Azadirachta and is resident in the Indian subcontinent and few parts of Africa. It is normally grown up in tropical and semi-tropical regions. The neem tree produces a huge volume of biomass surplus and Neem leaf is used to treat leprosy, bloody nose, intestinal worms, eye disorders, stomach upset, loss of appetite, skin ulcers, heart diseases, and blood vessels, fever, diabetes, gum disease, and liver problems. The various parts of neem can be utilized like leaves, flowers, seeds, fruits, roots, and bark, this obtained from neem trees can be widely studied and can be used as adsorbents to remove different pollutants in wastewater. Physical, biological, and chemical methods are conducted to treat wastewater but biological techniques using naturally rich adsorbents are continuously selected because of being outcome leaning, low-cost, effortless accessibility, and environment pleasant advantages. The usually utilized adsorbent is activated carbon, which is utilized to reduce the trace contaminants, but its usage is restricted since its greater primary and rejuvenation costs.

The primary understanding of the Varieties Chemistry of Neem components of neem leaves consists of protein (7.1%), carbohydrates (22.9%), vitamin C, minerals, calcium, phosphorus, carotene, etc. it also contains aspartic acid, alanine, praline, glutamine glutamic acid, tyrosine, and cystine like amino acids, and several fatty acids.

II. OBJECTIVES

This study aims to investigate the effectiveness of neem leaf powder as a natural coagulant to reduces turbidity of industrial wastewater from a lake with various dosages of coagulant, removes turbidity, and other contaminants with the optimal dosage of 10 gm/L. hence, this research shows the capability of neem leaf powder to treat wastewater. The conventional jar test procedure was performed to detect the performance of neem leaf powder and its coagulation action. Lake industrial wastewater from hennagara lake is utilized in this research it is a lake located in an industrial area in Anekal taluk, Bangalore.

III. MATERIALS AND METHODS

A. COAGULANT MATERIALS

The neem leaves were collected from a local neem tree near Chandapura. Analytical grade chemicals were used available in the research laboratory at the college. Neem leaf powder of 500 grams was made organically. The leaves were stored and kept in sunlight for a week, and leaves were stored and processed using a household food processor used in the kitchen. This powder was finely processed and used as a coagulant just into the sample for further adsorption procedure in wastewater treatment using neem leaf powder. Experiments were carried out on collected samples for investigational uses. Turbidity, Hardness, chlorides, and residual chlorine of water sample was tested earlier and consequently following the addition of coagulant with different Dosages of neem leaf powder i.e., 10, 20, 30, 40,50, and 60 g/L were added.

Fig 1: Neem leaf powder

B. REMOVAL OF TURBIDITY, HARDNESS, CHLORIDES, AND RESIDUAL CHLORINE

Turbidity measurement

Turbidity measures the colloidal fragments that appear in the accumulated water samples from hennagara lake. Samples were transferred into the nephelometer tube and check the turbidity reading precisely from the nephelometer instrument LCD panel display.

Hardness measurement

Calcium and magnesium ions from bicarbonates, chlorides, and sulfates in water cause hardness. Hardwater increases scaling, disturbs plumbing, and starts to corrosion effects. In industrial-scale water-softening factories, the sewage surge from the restoration technique can lead to scaling which disturbs the sewage systems.

Chlorides measurement

Chlorides are produced instinctively in surface and groundwater sources such as rainwater, seawater, and even tap water. it is also related to total dissolved solids. Generally in the chemical treatment procedure, the ratio of chlorides raises due to chemical material. Chloride matter will fluctuate based on rocks comprising salts, overflow after cultivated land to wastewater.

Residual measurement

Residual chlorine is due to the occurrence of free chlorine ions adequate in chlorine water which inactivates bacteria and viruses and also reduces water-borne diseases. If excess chlorine is present and when such water is used, when chlorine goes into the body it disturbs breathing and also leads to other numerous illnesses.

Removal of these contaminants is usually carried out by the method of flocculation, in this technique gentle and continuous combining of coagulated samples is done, which encourages the creation of 'flocs' during the blending of coagulant and turbid particles appear in the water. Flocs created can be normally separated by settling or filtration procedure. In this investigational work jar apparatus test was done with the supplement of alum before treatment and a jar experiment was also conducted after the adding of neem leaf powder in various dosages.

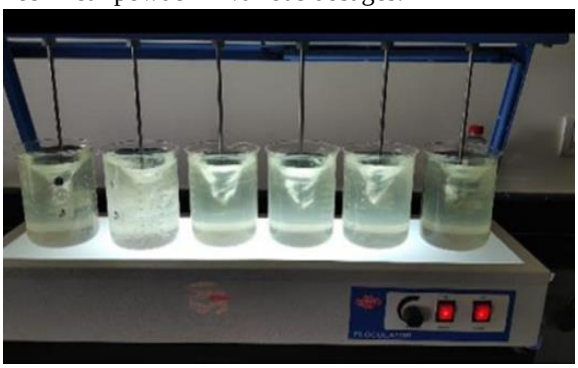


Fig 2: Jar test apparatus setup

C. **COLLECTION OF SAMPLE WATER**

In this laboratory analysis test sample, water was collected from hennagara lake is a lake in the suburb of Jigani in the southeast of the city of Bengaluru and is one of the largest lakes. The water was used for agricultural purposes in early90's. It is a part of the Jiagni drainage system that drains the southern and the south-eastern parts of the city. the whole surface water belt in the hennagara Industrial Area is severely contaminated with unprocessed industrial discharges. Several tests were performed before and after post addition of neem leaf powder.

Fig 3: View of Hennagara lake water

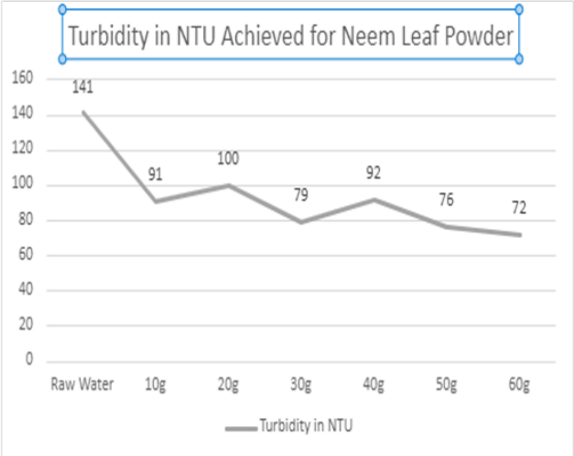
Fig 4: Collection of sample from Hennagara lake water

IV. RESULTS AND DISCUSSION

A. Turbidity test

Sl no	SAMPLE	Coagulant dosage in gm/L	Turbidity in NTU
1	Per-testing	-----	141
2	Post-testing of water	10gm/L Neem leaf powder	91
3	Post-testing of water	20gm/L Neem leaf powder	100
4	Post-testing of water	30gm/L Neem leaf powder	79
5	Post-testing of water	40gm/L Neem leaf powder	92
6	Post-testing of water	50gm/L Neem leaf powder	76
7	Post-testing of water	60gm/L Neem leaf powder	72

Table1: Removal of turbidity with different dosages of Neem leaf powder.

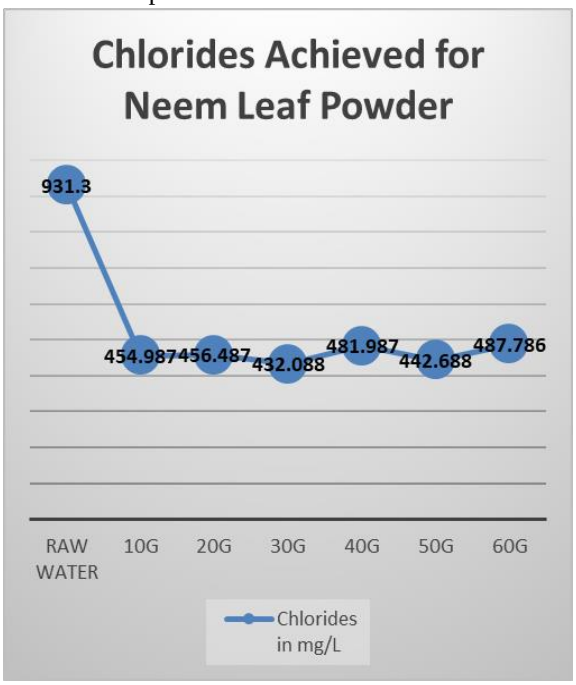


Graph 1: Removal of turbidity using Neem leaf powder

B. Chlorides

Sl no	SAMPLE	Coagulant dosage in gm/L	Chlorides in mg/L
1	Per-testing	-----	931.31
2	Post-testing of water	10gm/L Neem leaf powder	454.987
3	Post-testing of water	20gm/L Neem leaf powder	456.487
4	Post-testing of water	30gm/L Neem leaf powder	432.088
5	Post-testing of water	40gm/L Neem leaf powder	481.987
6	Post-testing of water	50gm/L Neem leaf powder	442.688
7	Post-testing of water	60gm/L Neem leaf powder	487.786

Table2: Removal of chlorides with different dosages of Neem leaf powder

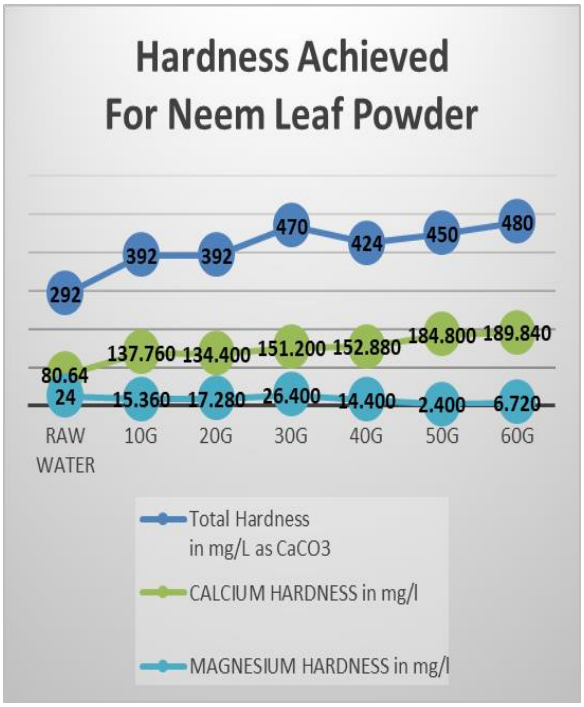


Graph 2: Removal of chlorides using Neem leaf powder

C. Hardness

Sl no	SAMPLE	Neem leaf powder Coagulant dosage	Total Hardness test values in (mg/L)	Magnesium Hardness test values in (mg/L)	Calcium Hardness test values in (mg/L)
1	Per-testing	-----	292	100	192
2	Post-testing of water	10gm/L	392	64	328
3	Post-testing of water	20gm/L	392	72	320
4	Post-testing of water	30gm/L	470	110	360
5	Post-testing of water	40gm/L	424	60	364
6	Post-testing of water	50gm/L	450	10	440
7	Post-testing of water	60gm/L	480	28	452

Table3: Removal of hardness with different dosages of Neem leaf powder.

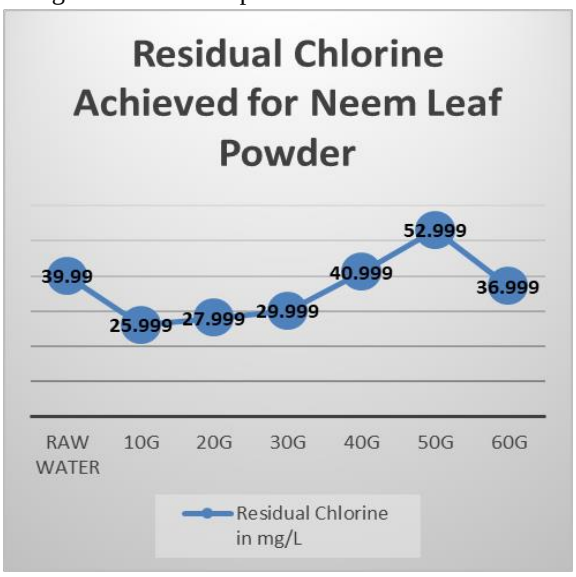


Graph 3: Removal of hardness using Neem leaf powder

D. Residual chlorines

Sl no	SAMPLE	Coagulant dosage in gm/L	Residual chlorine in mg/L
1	Per-testing	-----	931.31
2	Post-testing of water	10gm/L Neem leaf powder	454.987
3	Post-testing of water	20gm/L Neem leaf powder	456.487
4	Post-testing of water	30gm/L Neem leaf powder	432.088
5	Post-testing of water	40gm/L Neem leaf powder	481.987
6	Post-testing of water	50gm/L Neem leaf powder	442.688
7	Post-testing of water	60gm/L Neem leaf powder	487.786

Table4: Removal of Residual chlorine with different dosages of Neem leaf powder.



Graph 4: Removal of Residual chlorine using Neem leaf powder

V.CONCLUSIONS

From this present investigation work, it has been concluded that natural coagulants such as neem leaf powder can be used to remove contaminants in wastewater. Usually, the accessibility of secure and uncontaminated water is difficult particularly in rural regions since due to heavy rainfall water turns muddy and full of sediments. Therefore, using nearby accessible, abundant, and infinite natural coagulants provides the answer to the problems caused due to the treatment of wastewater. The methods involved are economical, traditional, easy to implement and decrease mortality and illness causes due to water-borne infections and this will enhance public health in rural areas. In this current research, the turbidity removal efficiency was found to be 49%, the removal efficiency of total hardness was found to be 34%, the removal efficiency of magnesium hardness was found to be 90%, the removal efficiency of calcium hardness was found to be 66%, The removal efficiency of chlorides was found to be 54% and removal efficiency of residual chlorine was found to be 35% post-treatment by natural coagulant neem leaf powder, for hennagara lake water sample. Consequently, it is noticed that natural coagulants are safe for wastewater treatment. Banana pith is consumer approachable and eco-friendly, a substitute for minor size water treatment.

VI.APPLICATIONS, ADVANTAGES AND DISADVANTAGES OF NEEM LEAF POWDER

Applications of Neem leaf powder coagulant

- To recognize a workable, easy, nearby obtainable.
- Biodegradable water treatment expertise which is more appropriate for the earth to safeguard it from contamination initiated by chemical coagulant.
- Evaluate the optimal dosages of neem leaf powder for various amounts to eliminate turbidity.
- Removal effectiveness is very high in neem leaf due to its anti-fungal and anti-inflammatory properties.

Advantages of Neem leaf powder coagulant

- It is non-poisonous and no side effects caused by consumption.
- It is eco-friendly.
- Neem leaf powder is abundant in organic compounds.
- Neem leaf powder has high-level nutrients.

Disadvantages of Neem leaf powder coagulant

- Accessibility of dried powder and availability is a little difficult.
- It needs a large amount of growth.
- It may cause smell due to use of NC.

REFERENCES

[1] Asha Rani. N. R "REMOVAL OF TURBIDITY BY USING NATURAL COAGULANTS SUCH AS MAGNIFERA INDICA AND MORINGA OLIFERA SEED POWDER" International Journal of Engineering Research-Online, Vol.9., Issue.1, 2021 Jan-Feb. pg no-14-21.

[2] Upadhyay shreya Rajendra 1 Asha Rani. N. R2 "Wastewater treatment using banana pith powder" International Journal of Innovative Science, Engineering and Technology, www.ijiset.com,Vol.8., Issue.5, 2021 May.

[3] Irfan Shariff.M 1, Asha Rani.N. R 2 "Evaluation of wastewater Treatment using Hyacinth bean peel powder as Natural coagulant" June 2021| IJIRT | Volume 8 Issue 1 | ISSN: 2349-6002

[4] Raksha. A 1, Asha Rani. N. R2 "Treatment of Wastewater Using Orange Peel Powder as Coagulant" International Journal of Scientific

Engineering and Applied Science (IJSEAS) – Volume-7, Issue-6, June 2021 ISSN: 2395-3470

[5] Arama Peter Futi1, Wagai Samuel Otieno1, Ogur Joseph Acholla, Walter Atieno Otieno, Owido Seth Ochieng and Mahagayu Clerkson Mukisira. "Harvesting surface rain waterpurification using moringa oliefera seed extracts and aluminum sulfate", journal of agricultural extension and rural development. May 2011. Page no.2.

[6] Sures narayasamy, halimi mohd saud (2014), "Water Sedimentation using Moringa Oleifera Seed Powder to Remove Water Turbidity in Malaysia", Journal of Agricultural Chemistry and Environment, 2014.vol.3,74- 79.(pg 75)

[7] Suleman A. Muyibi,Ahmed Hussein M Virima, Thamer A. Mohammed, Megit Gohari M.M.Noor, "Conventional Treatment of Surface Water using Moringa Oleifera Seeds Extract as a Primary Coagulant", IIUM Engineering Journal, vol.5,No.1,2004.(pg 26)

[8] Aho, L.MAnd Lagasi, J.E– "A New Water Treatment System using Moringa Oleifera Seed", American Journal of Scientific and Industrial Research, Vol.3 (6):487-492. (Pg-488)

[9] Vikashni Nand, Matakite Maata, Kanayathu Koshy, Subramanium Sotheewaran. "Water Purification using Moringa Oleifera and other Locally Available Seeds in Fiji for Heavy Metal Removal", International Journal of Applied Science and Technology.Vol.2. No5 May 2012. (Pg 126)

[10] Ravi Kumar K, Sheeja AK – "Heavy Metal Removal from Water using Moringa Oleifera Seed Coagulant and Double Filtration", International Journal of Scientific and Engineering Research, Vol.4, Issue 5, May 2014. (Pg 11).

[11] Malusare C. N, prof.milind R. Gidde. "Study of moringa oliefera extracts in water treatment", National Seminar vision 2025, technological development in biological science, vol.2, Jan-17-19, 2011.

[12] C.P. pise, Dr. S.A. Halkude. "A New technique for purification of water using natural coagulant", International journal of engineering and technology. Vol.6, Dec 2014- Jan 2015, page no.2564.

[13] Iloamuzor FE, Ude CN, Ezekannagha CB, Nwabueze HO. "performance evolution of moringa oliefera seed powder in surface water treatment and its coagulation kinetics", Journal of multi-disciplinary research and development. Vol.4, Jan 2017. page no. 36-41.

[14] ZehraSapci, BeyzaUstun. "The Removal of Color and COD from Textile Wastewater by Using Waste Pumice". Electronic Journal of Environmental, Agriculture and Food Chemistry (2003). [286-290].

[15] MilindR.Oidde, Julie Dutta, SnehalJadhav. "Comparative adsorption studies on Activated Rice Husk and Rice Husk Ash by using Methylene Blue as dye". International Congress on Environmental Research at Bits Pilani Goa (2008).

[16] RayalaAzath, "Colour Removal Studies on Silk Filature Composit Wastewater", M.Tech. Env. Engg. P.D.A.C.E.G, (1996).

[17] APHA, "Standard Methods for the Examination of Water and Wastewater", 19th edition (APHA, AWWA, and WFF Washington DC) (1995) pp 3.58-3.60.

[18] Renault, F., Sancey, B., Charles, J., Morin-Crini, N., Badot, P.-M., Winterton, P., & Crini, G. (2009). Chitosan flocculation of cardboard-mill secondary biological wastewater. Chemical Engineering Journal, 155(3), 775-783.

[19] Jahn, S. A. (2001). Drinking water from Chinese rivers: challenges of clarification. Journal of Water Supply: Research and Technology-Aqua, 50(1), 15-27.

[20] Mohapatra, D., Mishra, S., & Sutar, N. (2010). Banana and its by-product utilisation: An overview. Journal of Scientific and Industrial Research, 69(5), 323-329.

[21] Ahmad, T., & Danish, M. (2018). Prospects of banana waste utilization in wastewater treatment: A review. Journal of Environmental Management, 206, 330-348.

[22] Anwar, J., Shafique, U., Waheed uz, Z., Salman, M., Dar, A., & Anwar, S. (2010). Removal of Pb (II) and Cd (II) from water by adsorption on peels of banana. Bioresource Technology, 101(6), 1752-1755.

[23] Darge, A., & Mane, S. J. (2013). Treatment of Industrial Wastewater by Using Banana Peels and Fish Scales. International Journal of Science and Research, 4(7), 600-604.

[24] Jimoh, A., Abdulkareem, A., Afolabi, A., & Micheal, O. (2012). Development of Adsorbent from Banana Peel for Wastewater Treatment (Vol. 248).
[25] Kakoi, B., Kaluli, J. W., Ndiba, P., & Thiong'o, G. (2016). Banana pith as a natural coagulant for polluted river water. Ecological Engineering, 95, 699-705. doi: 10.1016/j.ecoleng.2016.07.001
[26] Anhwange, B. (2008). Chemical composition of Musa sapientum (banana) peels. Journal of Food Technology, 6(6), 263-266.
[27] Prieto, A. L. (2011). Sequential anaerobic and algal membrane bioreactor (A2MBR) system for sustainable sanitation and resource recovery from domestic wastewater. Graduate School Thesesand Dissertation. Retrieved from http://scholar commons.usf.edu/etd/3296.
[28] Malay Chaudhuri and Putri Sarah Aainaa Binti Khairuldin, "Coagulation-Clarification of Turbid Coloured Water by Natural Coagulant (Moringa oleifera) Seed Extract", Nature Environment and Pollution Technology, Vol 8(1), 2009, pp 137-139.
[29] Marina Sciban B., Mirjana Vasi A., Jelena Prodanovi M., Mirjana Antov G. and Mile Klasnja T., "The investigation of coagulation activity of natural coagulants extracted from different strains of common bean", APTEFF, Vol 41, 2010, pp 141-147.
[30] Marina sciban B., Mirjana Antov G. and Mile Klašnja T., "Extraction and partial purification of coagulation active components from common bean seed", APTEFF, Vol 1, 2006, pp-37.
[31] Marobhe N. J., Dalhammar G. and Gunaratna K. R., "Purification and Chara Simple and Rapid Methods for characterization of Active Coagulants from the Seeds of Vigna Unguiculata and Parkinsonia Aculeata", Environmental Technology, Vol 28, 2007, pp 671-681.
[32] Mirjana Antov G., Marina Sciban B., Slavica Adamovi R. and Mile Klasnja T., "Investigation of Isolation Conditions and Ion-Exchange Purification of Protein Coagulation Components from Common Bean Seed", APTEFF, Vol 38, 2007, pp 3-10.
[33] Mirjana Antov G., Marina Sciban B. and Nada Petrovic J., "Proteins from common bean (Phaseolus vulgaris) seed as a natural coagulant for potential application in water turbidity removal", Bioresource Technology, Vol 101, 2010, pp 2167-2172.
[34] Moises Oliveira A., "Production of Fungal Protein by Solid Substrate Fermentation of Cactus Cereus Peruvianus and Opuntia Ficus Indica", Quim. Nova, Vol 24(3), 2001, pp 307-310.
[35] Nebbache Salim, Chibani Abdelwaheb, Chadli Rabah and Bouznad Ahcene, "Chemical composition of Opuntia ficus-indica (L.) Fruit", African Journal of Biotechnology, Vol 8(8), 2009, pp 1623-1624.