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Review Article

Review on Water Purification by Using *Moringa Oleifera* Seed

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Abstract

Impure water leads to several ailments in humans, animals, and poultry. Water stored in tanks at farms becomes impure due to development of algae and other toxicities. There is also another method of water purification by using *Moringa Oleifera* seed. The water-soluble proteins extracted from *Moringa Oleifera* (*MO*) seeds was investigated by Fourier transform infrared spectroscopy (FTIR) in the dry state, as well as circular dichroism (CD) spectroscopy. FTIR and CD spectra show that the secondary protein structure is dominated by αs-helix. The FTIR spectrum recorded two separate and strong absorption belts at 1656 cm - 1 and 1542 cm - 1, in a standard list of protein absorption proteins. Changes in solution pH affected the formation of the second largest protein only at pH values above 10, as shown by the CD spectra, while ionic energy had a small effect. The main objective of this review was to investigate the efficacy of extracting of *Moringa Oleifera* seeds in three ways: simple wrapping, oil extraction, and protein separation. This leads to an increase in efficiency in determining water with low turbidity. In addition, the new bio-coagulant faced the limit of previous research, namely the loading of organic compounds into water after the *Moringa Oleifera* seed mixing process. This method brings many benefits compared to others, in particular, the use of chemicals, low cost, easy to use but equally effective and safe for health. In addition, a paired t-test used to compare a set of pre-treatment and post-COD treatment data with the success of turbidity removal was significant ($p < 0.05$) at the three sites examined.

Keywords: Bio-Coagulant; Protein-Fractionation; Turbidity; *Moringa Oleifera* ; A-Helix; PH Value; Pulverization

Introduction

Impure water is very dangerous for animals and poultry. Water stored in tanks at livestock farms for animals drinking purpose is toxic. Due to impurities it promotes the growth of blue green algae and leads to several harmful effects on health like muscle tremors, liver damage and death. *Moringa Oleifera* (MO) is a tropical plant that is part of family Moringaceae. The plant grows rapidly even in the ground and low humidity. It is known to be non-toxic for people and animals. The seeds of this plant contain active coagulating agents that are identified as cationic proteins with a molecular weight of 13 kDaand iso electric with pH between 10 and 11. It is said that in the future compound proteins extracted from MO seeds can be a powerful challenge for synthetic coagulants for water purification and basic healing industrial and domestic wastewater. Additional benefits of using coagulants found in MO that value products may be extracted from seeds. In particular, edible as well as other essential oils that may be extracted before the coagulant becomes divided. In addition, the remaining solids can be used as animals feed and fertilizer, while the seed shell may be activated and used as an adsorbent [1-3].

The secondary structure of the polypeptide chain section it is the local system of its atoms in the main series outside about the structure of its side chains or its relationships and other parts. Knowing the three-dimensional structure of a protein, that is, knowing the relative position of each atom in the atmosphere, can provide information about the potential sites in proteins, making it possible to analyze or determine the function of a protein. The study of determining and predicting the secondary protein structure therefore found an important place in both the experimental and statistical areas of research. Data regarding the second structure and the corresponding mutations of the coagulant protein extracted from MO seeds are not available. In addition, a number of conflicting methods have been proposed to explain how the extracted protein purifies water.

Circular dichroism (CD) and Fourier transform infrared (FTIR) spectroscopy are frequently used to separate proteins according to the secondary structure of motifs. It is generally accepted that CD ratings provide more accurate estimates of protein a helix content while infrared (IR) is thought to be more sensitive toβsheet. Since the potential sources of error in the CD and FTIR strategies are different, they may be considered complementary strategies [4]. The IR spectra are used to analyze proteins because they acquire an amide bond, which exhibits different IR signals of different coagulated proteins.

FTIR spectroscopy has been widely used in studies of second protein structure in solution and dried form Amide I sensitive band, caused mainly by the volatile carbonyl vibration of protein backbone and extends 1700-1600 cm - 1, often used for a separate second assignment protein structures. Asymmetrical proteins molecules are composed of different structural elements, including α-helical, β-sheets, b-turn and unordered. CD in between the UV remote region allows for α-helix measurement of the whole and β-sheet protein content, as well as a number of algorithms there are those who use data from a remote UV CD spectrum to provide theeasuring the formation of a second protein structure

Coagulation and flocculation are physicochemical processes commonly used in water treatment, as these are important processes to reduce turbidity and microorganisms in water. In addition, concentration and coagulation also contribute to increasing the effectiveness of subsequent treatment processes such as sedimentation, filtration and sterilization [5,6].

Flocculants are divided into natural, organic or synthetic polymers. In conventional therapeutic procedures, different types of flocculants are often used depending on the chemical properties of the contaminant in the water. Aluminum sulfate is important often used for the treatment of drinking water. However, many studies have shown that the use of alum can be extremely dangerous to human health.

For the past ten years, solutions activated electrochemically (ECAS) is widely used in Industry food production, biotechnology, health care settings and drinking water treatment and concluded that ECAS has played a roleuch as self-forming acidic (acolyte) or basic conditions (catholyte), selected proteins and fiber extraction, inhibition development of microorganisms in food or biomaterial. Catholyte and acolyte were used to extract gelatin from fish skins. Using ECAS is eco-friendly and efficient way. As mentioned in this study, protein *Moringa Oleifera* seed extraction has improved this use of ECAS as a solvent released after step to extract oil with n-hexane. *Moringa Oleifera* seeds almost melted into ECAS at that time to you and dried. This released product is rare biodegraded by microorganisms due to antioxidant from ECAS. Polyaluminium chloride (PAC) is popular e The coagulation-flocculation process due to its quantity benefits over metallic salts (aluminum and iron salts). Many researchers have found that PAC works better low temperature, few aluminum residues, the formation of small mud, a wide pH (5.5-8) of raw water activity, and flocculation more quickly Recently, many studies on the coagulation processes of PAC concludes with a combination of adsorption-charge neutralization process, such as electrostatic pool, sweeping coagulation and bridge integration, as a result high values of Al13 [AlO4Al12 (OH) 24 (H2O) 127þ] and Al30 [Al30O8 (OH) 56 (H2O) 2418þ] investigated the matter efficiency of various pre-hydrolyzing coagulants water purification and concluded as PAC products provide faster flocculation and stronger flocks than alum at the right rate. reporting I to compare the effect of *Moringa Oleifera* seeds extraction with different concentrations of sodium chloride and PAC incorporating coagulant into the purifier mixed water from 10 to 1,000 NTU. These writers showed that *Moringa Oleifera* seeds were very effective there is a PAC in the treatment of high sewage [6-8]. In contrast, PAC had better clean-up effect in low turbidity, and a soft pressed cake from *Moringa Oleifera* seeds were found to be more effective than commercial one's coagulation agents PAC to treat black dye 19 in pH 5-8 at any temperature. So, it is necessary investigate the use of *Moringa Oleifera* seeds extracted differences between *Moringa Oleifera* seeds and c Use of bio-coagulant based on such plants.

Moringa Oleifera seeds will help sustain, economically environmental practices by producing such great benefits as biodegradability, a low indication of residual mud formation and non-toxic, as well as stainless nature, and tying water and cleaning wastewater can help. reduce dependence on chemicals The objectives of this study were to: (1) analyze the impact of forms issued by *Moringa Oleifera* as coagulant, and this show *Moringa Oleifera* extract powder with chemical elements; (2) comparing impact on turbidity, removal of COD and E. coli in lake water and in the municipality contaminated water between *Moringa Oleifera* extract and PAC for common coagulant; and (3) elevating the volume of coagulant in water treatment. Currently a new trend in the development of water treatment using natural materials for benefits such as low cost, preventing changes in pH (Power of Hydrogen) of clean water, which reduces the amount of mud production and especially biodegradability. Other studies have found natural coagulants in *Moringa Oleifera* (M. Oleifera), a genus of 14 species of Moringa. Through the results of a previous study, found that Moringa is flocculants are completely natural and waterproof. The coagulating agent in More seeds can be identified as a molecular protein weighs about 6.5 kDa, and the isoelectric point is above the pI10. Amino acid analysis and sequence showed value 60 residues, and this peptide has been reported in protein database also named MO2.1 In addition, N dabigengesere., *et al*.1995) also demonstrated the ability to concentrate on both shells and kernel. The power to remove dirt is Moringa can achieve an efficiency of 76 - 98% (Gaikwad and Munavalli 2019), as well as the efficacy of disinfection after treatment can benefit more than 90% (Delel., *et al*. 2018). In addition, there are many lessons to be learned prove that the seed of M. Oleifera dissolved in water is absent is harmful to human health and can be used to treat water. M. Oleifera is known as a useful tree with many different functions. In Vietnam, this tree grows in other provinces such as Thanh Hoa, Ninh Thuan, Binh Thuan and An Giang, but the data were researched in the coagulant of M seeds. oleifera for inclusion in the treatment of surface water is still limited. So, this is a lesson made with the use of M products. Oleifera seeds after oil production as a natural coagulant for surface water treatment by case study used in. I am interesting point is that its water purification ability is available in both cases of M seeds. oleifera and their products thereafter oil production. The results of this study revealed that they do exist promising and environmentally friendly things the cost of treating excess water. It is especially useful for the rapid treatment of surface water for the home purposes of residents in areas affected by emergencies. as food when natural sanitation is bad and a lack of clean water. commercial coagulant PAC treatment area water [9].

Research that includes alternative water treatment methods reports the use of MO, such as, for example, to change the surface of the commercial membrane, in order to improve the vital membrane. Finally, in order to make its application to real systems are possible, mixed treatments have also been investigated through the gate, using a variety of unit functions and utilizing the power of MO both to maximize process efficiency as well to increase the useful life of the materials. A common growing practice in MO seeds in water purification a total of 258 articles were published on the Web of Science database with keywords "Moringa" and "water purification" as a search goals. Among these, I a large number of text type are research topics that cover about 84 percent of the published version. Growing research the trend puts MO seeds as a topic of interest in major research in the middle some natural-based coagulants for water treatment, from above more than 50% of articles published in the last 5 years. Therefore, the purpose of this study was to conduct in-depth research a review of MO seed use practices for water purification, aimed at in its various applications and their results, to bring a An overview of the technical and practical information of the working scientist in this field and identifying information spaces to block future research guidelines. Concerns about marine pollution Increased especially in the surface water used human consumption. Adequate water treatment and sanitation they are important to remove dirt and other contaminants. Coagulant Addition is a necessary step in the specification of water, which is aluminum sulfate (alum), is a coagulant commonly used worldwide However, indestructible mud is produced and remains aluminum in water can be certified,]. Therefore, lessons using natural coagulants like *Moringa Oleifera* get more attention. Use of M. Oleifera seed prevents the presence of all-dissolved aluminum in water and mud, producing decaying mud with high nutritional value in addition to introducing the efficacy of arsenic extraction, surfactants and pathogens in water, M. Oleifera coagulant is the same studied to be used to remove cyan bacteria cells. Care should be taken to remove cyan bacteria from water accounts and algae blooms often in areas of water, where One of the most common types of cyan bacterial bloom is Microsystems aeruginosa species Studies examining the removal of Microsystems and another type of M cyan bacteria M. Oleifera coagulant however they are still in short supply and the use of this natural coagulant can be shown to be an interesting alternative to aluminum. Coagulants, commonly used in high doses for cyan bacteria blooms are present in the water [10,11]. M. Oleifera Lamarck is the most widely distributed species in the world when referring to the Moringaceae family Produces 2000-20,000 seeds per year, the use of seeds as a coagulant enables the production of 60,000 L of drinking water, with the addition of 50 mg L 1.Capacity. In addition, no toxins are expressed in the seed once no changes in pH and apparent conductivity when using this the products of developed countries would not be needed if M. Oleifera coagulant is used when grown in large quantities taste the world.

Coagulation-¯flocculation followed by sedimentation, ultrathin and disinfection, usually chlorine, is used worldwide in the water purification industry before the supply of clean water to consumers Aluminum salt is the most widely used in water purification and wastewater treatment However, more recently. Studies have shown a number of serious barriers to the use of aluminum salts, such as Alzheimer's disease and similar health problems related to residual aluminum in fresh water, without the production of large volumes of mud. water leads to lower pH and lower efficiency in the incomparably cold-water economy that many developing countries cannot afford the high cost of imported chemicals to purify water and wastewater). Current research tends to produce additional active aluminum coagulants, such as polyaluminum chloride (PAC) and polyaluminum silica sulphate (PASS) Although these new coagulants have improved the well-thought-out bonding process, they did not address all of the barriers mentioned earlier Ferric salt and synthetic polymers have also been used as coagulants but with limited success, due to the same disadvantages as aluminum salts Therefore, it is desirable that some coagulant less expensive and environmentally acceptable be developed to add otherwise. alum, ferric salt, and synthetic polymers. In this context, natural coagulants provide an alternative to natural vegetable coagulants and mineral origin were used in water treatment before the advent of chemical salts. *Moringa Oleifera* is a tropical plant that is part of the Moringaceae family. So far up to fourteen species have been identified, all with varying degrees of *Moringa Oleifera* activity is the most widespread, fast-growing species in low-lying areas throughout the tropics, including dry areas in general. known in developing countries as a vegetable, medicinal plant and a source of vegetable oils. However, in Sudan it has been traditionally used for water purification. This extensive use of the *Moringa Oleifera* plant greatly encouraged its widespread use. It has become a popular plant to grow near homes due to its aesthetic properties, such as fencing and viding texture. and that they are not toxic to humans or animals. They are extremely effective in reducing turbidity and microorganisms from raw water and in fixing mud. The active coagulation agents are diametric cationic molecular weight proteins about 13 kilo dal tons (kDa) with an iso-electric point between 10 and 11. As a coagulant, the extraction of raw *Moringa Oleifera* seeds is well compared with alum, and its use as an effective coagulant has been recommended in developing countries to reduce the high cost of water purification. Utilizing this natural mix in developing countries can effectively alleviate their economic situation and allow for more water expansion in rural areas. However, apart from traditional use in other laboratory or experimental settings, no major abuses of *Moringa Oleifera* in water purification have been reported to date. This rejection could be explained by the introduction of Moringa as a low-cost technology suitable only for developing countries Another way to promote the acceptance of Moringa as a global coagulant is to clearly demonstrate its benefits over conventional coagulants and to use modern technology to provide the industry with water and waste. Previous research has largely focused on the efficacy of *Moringa Oleifera* seeds as a coagulant, but there is a need for systematic testing of water quality treated with *Moringa Oleifera* seed extract extract. The purpose of the present study was to evaluate the various water quality parameters treated in combination using *Moringa Oleifera* seeds, and to compare them with those treated with alum.

Analysis

A sample is filtered through the membrane, soothe bacteria is retained on the surface membrane. The results are that the number of colonies on m TEC is red or magenta in color after the incubation period. The turbidity, COD, and E. coli removal efficiency (H%) were calculated using Equation (1) as follows: H 14 C0 CC0x100%. The chemical composition of *Moringa Oleifera* extract seed powders (moisture, ash, fat and protein contents) was determined according to standard methods 934.01, 942.05,991.36 and 954.01 respectively (AOAC).

Moringa Oleifera seeds were harvested in the province of BinhThuan, Vietnam. Seed that did not rot was selected. old, or infected with seed insects. The seeds were hung in the oven for 24 hours at 40 C. After that, the seeds were ground into a powder using a blender. This powder is known as MO1. In addition, MO1 reduces fat by releasing it with n-hexane. The extraction process was performed 3 times with a 3: 1 n-hexane/powder ratio (v/w) at 45 C for 15 minutes under ultrasound with an ultrasonic purifier. The solids are filtered and dried at 50. Refined flour was suspended in a filtered electrochemical solution produced using an electro activator trigger (with pH 9.0 in a 1/10 (w/v) suspension. rpm 20 minutes for 10 C. Dry rain and ice at room temperature of about 20-25 c [33-35,29].

The IR spectra was recorded in the PerkinElmer System 2000 FTIR. Protein powder (stored at ambient temperature) is measured at 1 mg with 200 mg KBr protein. After homogenizing with agate mud and pestle, the powder was pressed into pellets using a 15-ton hydraulic press. Data were collected at a resolution of 2.0 cm - 1, and each spectrum was the result of 256 scans. The spectra were then analyzed in the spectral regions of amide I-III. D spectro polar meter using solvent concentrations of protein 0.5 mg/mL in a 0.1-cm cell. The spectrum of each CD was collected in three scales at 50 nm/min with a spacing of 1-nm for a fixed time s 1. Data collected from 190 nm to 260 nm at a time of 1 nm. To measure the synthesis of a second protein structure, CD ellipticity by degrees was converted into cellular ellipticity using cell length and number of amino acid concentrations in coagulant proteins and protein concentrations. The accuracy of the test is determined by the preparation of protein solutions from the concentration of the tested protein by weight [25,27,33,39,40]. Information on the UV absorption coefficient is needed to calculate the total amount of protein. The content of the second structure such as a-helix and b-structure of coagulant protein was then calculated according to the K2D system. using DICHROWEB software, an online protein server that analyzes the second structure from CD data. The location of the solution such as ionic energy, pH and surfactants presence can affect protein formation. The effect of ionic energy on the second structure of proteins in tigated water. Ionic energy was divided by the addition of 1.0 M sodium chloride is a protein solution and CD was used as an ionic energy function. To calculate the pH effect of a second protein structure, the CD spectra of samples is measured at different pH values. Solution pH in range 4.0-12.0 prepared with the addition of sodium hydrox ide (0.1 M) or hydrochloric acid. The pH is measured with the Hanna Instruments model 209-meter pH. To study the interaction between SDS and coagulant protein, CD spectra SDS/protein solutions were recorded. SDS (99% purity) was provided by Sigma-Aldrich and used without further purification which explains the minimal stress seen in the area against the SDS torture structure only. Protein concentrations have been kept constant while surfactant concentrations have varied to higher concentrations than essential concentrations of micelle (cmc) [12-14,24,27].

Investigation of coagulant protein secondary structure by infrared spectroscopy was done in the dried state. In the amide II region the band at 1542 cm-1 supports the dominant presence of a-helices F. In the amide III region, the band at 1291 cm-1 shows that the protein has mainly -helix secondary structure. This finding is supported by CD data discussed below. The spectrum showed essentially the same absorption bands as the purified protein in the amide I and II regions. generally, in solution). Thus, further investigations are necessary to study the infrared spectra of the coagulant protein in aqueous solution. The far UV CD spectrum of the coagulant protein is shown in figure. The spectrum shows a typical shape and features of a mainly a-helical secondary structure, i.e. This confirms earlier results from infrared spectrum, which indicated that the secondary structure of the coagulant protein is dominantly - helical. Effect of ionic strength In order to study the effect of ionic strength on the secondary structure of the coagulant protein, the CD spectra of the protein were taken at different ionic strengths and the results are shown [15-18].

In order to study the effect of pH in the range 4-12 on the secondary structure of the coagulant protein, the CD spectra of the protein are plotted in Fig. The plot shows that pH has no significant effect on the CD spectrum or secondary structure up to pH 10. In other words, changes in the tryptophan environment cannot necessarily be associated with the changes in secondary structure.

Statistical analysis

All statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) Version 22.0. The threshold for statistical significance was set at p0.05. To verify the significance of differences among the means, a one-way analysis of variance (ANOVA) with the least significant difference (LSD) test was used. The significance of the differences between the two means was confirmed using an independent sample test (t test) [19-21,29,30].

All of the experiments were done in triplicate to ensure that the results were consistent. The average of the three was used to arrive at the final findings. A Student's paired t-test was used for all statistical analyses of the data. Statistical significance was established as a value of less than 0.05, and the data was analyzed using Microsoft Excel 2010.

Conclusions

The results showed that *Moringa Oleifera* seed extraction methods were as expected: *Moringa Oleifera* integral powder (MO1) shows higher oil content than *Moringa Oleifera* seeds after oily extraction (MO2) and protein components (MO3) are reduced by 95.65% and I 98.55% of MO2 and MO3, respectively. In addition, it is an important product that can be processed and reused. The percentage of protein released was much higher than that released by salt, or ethanol). Rates were 32% and 42.9%, respectively. MO3 samples were mainly protein (by dry weight), and the content of lipid, ash and low carbohydrate showed the effect of electrochemical dehydration (a catholyte with pH 9.0). The pH of water in the Van Quan lake is slightly lower due to the growth of algae. The DO volumes of water samples were as low as 2.2 and 1 mg/L in municipal water and wastewater, respectively. 9 Both water samples are highly contaminated with high levels of BOD5 and COD. BOD5 levels were as high as 65.55 to 111.5 mg/L in lake water and municipal wastewater, respectively. The main part of the To Lich River and the Van Quan Lake are polluted water, so nutrient uptake in the river is often very high. In Lake Van Qua, these effects were lower than those of the To Lich river, however, they were still higher than Vietnam's water quality level. Both water samples had higher values than the threshold specified in the Standard and exceeded the frequency. The TSS parameter in both water samples exceeded the Standard (category B1 at 50 mg/L). In short, both water samples have been contaminated with respect to turbidity, living pollutants, and microorganisms.

The IR and CD spectra of coagulant protein are found in the second formation of multiple helices. The CD spectrum suggested that the coagulant protein of the second structure was controlled by helical components measuring 58 ± 4% and sheet content was 10 ± 3% and the additional components allocated to about 33% of non-ordered properties. Studies show that FTIR and CD spectroscopy are complementary techniques in investigating the secondary structure of coagulant protein extracted from MO seeds. The CD also points out that alignment changes are possible due to the addition of anionic surfactant SDS. The Addition SDS renders the earth protein-free following a revelation, which is accompanied by a change in the elasticity of the leaf from the peptide (amide) bond of coagulant protein. Coagulation changes caused by Coagulant protein surfactant are confirmed by tryptophan depletion protein fluorescence. The pH and ionic energy did not have a significant effect on the proteins of the second coagulant structure, promoting protein-related stability under applied conditions. Further research is needed with IR spectroscopy to further visualize the secondary properties of coagulant protein solution.

Oleifera coagulant is rotten, non-toxic and easy to use. The efficacy of COD removal increased gradually as the doses increased from 0.05 to 0.15 ml L1 and reached approximately 25.3, 20.8 and 15.7% in three areas S1, S2, S3, respectively.

three factors did not significantly affect the pH value, which remained virtually unchanged at about 7.64 in all tested doses. In contrast, the pH value decreased from 7.64 to 5.51 in the PAC Coagulant PAC containing aluminum-based polymer, and forms aluminum hydroxide when in contact with water, becoming cationic by reacting with alkalinity of water. Increased acidity may occur due to aluminum trivalent cation acting as Lewis acid and receiving ion-electron pairs. The formation of Hþ ions to reduce the pH of water followed by Equation I-Al3þ þ 3H2O! Al (OH) 3 þ 3Hþ (2).

639 N. T. Hoaand C. T. Hue | Improved water treatment by *Moringa Oleifera* seeds published in the Water Supply Journal: In contrast, materials produced with *Moringa Oleifera* seeds are composed of organic molecules that are produced and ready for cationic use.

How to separate protein from *Moringa Oleifera* seeds discussed in this study is simple, and easy to use on an industrial scale. Using hexane to remove oil and extract protein with an electrochemically activated solution in a new way to produce a new bio-coagulant. Compared to PAC coagulant, the most popular compounding agent, the MO3 protein separator has not only succeeded in removing turbidity and COD, but also E. coli in the treatment of pool and domestic wastewater. It has the potential to make it a commercial product - bio-coagulant replacement Regular chemical coagulant (PAC) - has many advantages such as improved water hygiene, greater environmental protection, less mud formation, biological decay and lower costs. In this study, the challenge presented was compounding the complex process to measure the process in water purification plants. The various limitations of coagulation-flocculation technology require precise control in order to find the efficiency of the process. Therefore, benchmark tests or tests and errors are always necessary find the most effective coagulant, pH range and alkalinity value for a specific volume.

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