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SUSTAINABLE TREATMENT OF CONTAMINANTSFROM BILBEIS DRAIN, EGYPT, BY QUERCUS (RED OAK) AS A NATURAL COAGULANT FOR REUSE.

A. MAREY

Department of Basic Science, The Valley Higher Institute for Engineering and Technology, Obour 11828, Egypt. ameraraafat9@gmail.com

Abstract

The objective of this study is to examine the applicability of (Quercus spp.) or Oak Leaves) as an environmentally friendly naturally occurring coagulant to reduce higher water turbidity and overall suspended solids by reducing the percentage (COD, BOD, TSS, TN, TP and ammonia) using the coagulation-flocculation method used ja The substitution by natural product components of organic and inorganic coagulants/flocculants may not only minimise ecosystem harm, but also improve the path to a new era of clean technologies and sustainable environments. The Egyptian wastewater treatment facilities have a total capacity of 5 million cubic metres per day and have been gathered from the Bilbeis drain between the City of Zagazig and Qalubeya in Egypt with support for the minister of households. Firstly, Oak Leaves powder was cleansed, rinsed with NaCl distilled water and salt solution, dried, crushed and afterwards finely sieved. The coagulation studies conducted by means of jar tests were different operating parameters such as pHs (2-9) and coagulant dosages (10-80 mg/L) and revealed an optimum coagulant dosage of Oak = 40 mg/L at pH 5, TDS = 78.8 mg/L and TSS = 92.33 mg/L and a reduction of 43.4 mg/l at an average turbidity of 52.20 NTU to 4 NTU. Summary of these investigations: to evaluate the interpretation of natural coagulant for waste water treatment, additional water quality indicators, such as hardness, Ec(electrical conductivity) and total alkalinity, were measured. In addition, this article focuses on where future study should concentrate on the use of green chemicals and natural goods to be used in water treatments for the purpose of a safe environment with sustainable applications in waste water treatment.

Keywords: Clean technology, Bilbeis Drain, Natural coagulant, Coagulation, Flocculation, Turbidity, Oak leaves, (quercus spp.) Sustainable.

1.Introduction

Forever those later years, researchers postulate that there is no wonder on the critical threats caused by the thick spread of chemical reagents to remediate fresh water and wastewater using more advanced methods of treatment which is physicochemical process, like coagulation-flocculation technique. As the world's population keeps to grow there is an excess amount of pressure on our water bodies from human actions and a changing climate. Renovation of the world with rising living standards has caused the water utilize to raise by a factor of six over the past 100 years [1].The excess strain on water bodies currently being used as sources for drinking water can cause the water

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quality to reduce, making it substantial to treat before human consumption. As a way to conflict water stress in areas with high and ultimatehigh-waterstress, wastewater can be treated to drinking water goodness and reused as potable water. This choice is costly, making it not viable in developing countries, and is still met with some uncalled-for doubt from the consumer. Historically evacuation of untreated wastewater has been one of the main contributors to local pollution in the world. Untreated domestic wastewater contains organic matter, nutrients, and pathogens, however industrial wastewater can in addition to the prior pollutants include heavy metals and a diversity of other substances. absolute discharge of untreated or not sufficiently treated wastewater can cause eutrophication and the diffusion of pathogens between humans. It is essentially doubtful when the beneficiary of the wastewater is utilized as a drinking water origin.the requirement for wastewater treatment was realized during the mid-nineteenth century and consisted fundamentally of mechanical treatment concentrated on expelling the organic matter. Ever after, chemical and biological treatment processes have been improved to realize higher treatment performance. Even though the technology is ready not each country can bear or selects to prioritize the cost of comprehensive wastewater treatment. A report done byWorld Health Organization(WHO),revealed that 22 of 79 countries who shared in the study, fundamentally establishedin Europe and America, treated 50% or Coagulation-flocculation is the best method used in the sewage treatment plant because of its impact. 38,37

The purified Oak seed extract obtained optimum removal efficiency and an optimal elimination performance of 92.3%. Fig. 9: Shows the stages of flocculation. Both the natural polymers have the properties to operate across a broad pH and do not convert the pH of the treated water. The removal of particles in water treatment is regulated according to the turbidity parameter. The turbidity/particle extraction method by Oak is established to be charging neutralisation, bridging, electrostatic stain removal and spreading, Fig. 10. (Natural polymers such as polyelectrolytes operate and are composed of a variety of charged and functional groups, such as –OH, –COOH and –NH2. Coagulation includes bridging, charge neutralisation and coagulation of spread and compression of the electric dual layer of charged colloidal particles 39. Carbohydrates, proteins and lipid macromolecules are usually components of bio-coagulants. The main ingredients of polymers used in wastewater treatment are polysaccharides and amino acid 40. Other operational coagulants across anionic contaminating particles include polyelectrolytes with cationic charge. The presence of charge on both polymer and contaminated particles creates electrostatic attraction and dense pollutant particles significantly absorbed while achieving a balanced reversal of charges from the outer surface of polluted particles. Next neutralisation these particles come into touch and create flocks which may readily be cleaned 41 polyelectrolytes with a high load density have the flocculation capacity to load the particles more effectively. A contemporary phenomena occurs on the surface of a pollutant, polyelectrolytes with

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higher cationic load density, with lower anionic load densities, which is termed electrostatic patch mechanism 42. The coagulants in the form of hydroxide are precipitated, while the colloidal particles dissolved in water are swept from the water and restricted by a coagulant precipitation. This technique removes harmful chemicals 43. This technique works in chitosan wastewater treatment. The major elimination mechanisms for turbidity in a soil with a negative pH are load neutralisation and bridging44.. Jar Test Appliances (Four/six Stirrers 5 - 150 Rpm, Electronic, 230V, 50Hz, 100W, 25 to 200 rpm range) The jar test is a widely used technique to achieve and optimise the clotting method – flocculation based on conventional methodologies. 45, the 1000 ml(1 L) beaker was filled with 300 mL of raw wastewater to carry out this experiment, while the usual jar procedure was followed at a constant air temperature of 25 oC. Each beaker agitated throughout the coagulation phase, including 1 minute rapid mixing (160 rpm), followed by 10 min gradual mixing (30 rpm) for 15 min for flocculation. After 1 hour of settlement, the surnatant was filtered through a robust filter paper (0.45 microns) for filtrate removal from the active coagulant. This filtered solution was used as a dosage of bio-coagulants in Jar Test studies, in order to avoid any impact, such as viscosity, coagulation and pH alterations, the solution should be available and maintained in a cooler every day. Before using it, the solution must be shaken thoroughly. After sample settling, a surnatant volume was taken from the surface of the beaker at a distance of 5 cm, to identify the optimum pH value turbidity and other water quality characteristics, tests were conducted in pH range (2-9). Different concentrations of coagulant potion, which ranged from 10 to 80 mg/l, were used to treat increased efficiency with increasing levels of potion. The input factors of the coagulant dosage and pH were the following: electrical conductivity, organic matter..

Fig.1. Bilbeis Drain System/ Egypt

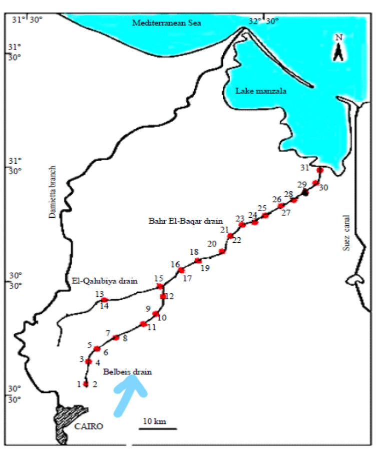

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Fig.2. Oak Leaves and its Seeds

Table 1: a series of plants recognized as natural coagulants in water treatment[17].

Plant species	Family	Part	Coagulant type
Abelmoschus esculentus/Hibiscus esculentus (okra)	*Malvaceae*	Mucilage	Neutral*
Amorpha fruticosa (indigo bush)	*Fabaceae*	Seeds	Unknown
Aesculus hyppocastanum (Horse chestnut)	*Sapindaceae*	Seeds	Unknown
Cactus latifaria	*Cactaceae*	Mucilage	Neutral*
Cassia alata (candlebrush)	*Fabaceae*	Leaves	Unknown
Castanea sativa (European chestnut)	*Fagaceae*	Seeds	Anionic*
Ceratonia siliqua (carob; locust bean)	*Fabaceae*	Seeds	Neutral*
Cicer arietinum (chick pea)	*Fabaceae*	Grains	Unknown
Coccinia indica (ivy gourd)	*Cucurbitaceae*	Fruit	Unknown
Cuminum cyminum (cumin)	*Apiaceae*	Seeds	Unknown
Cyamopsis psoraloides/Cyamopsis tetragonoloba (guar)	*Fabaceae*	Gum	Neutral
Dolichos lablab (hyacinth bean)	*Fabaceae*	Seeds	Neutral*
Glycine max (Soybean)	*Fabaceae*	Seeds	Unknown
Hibisicus sabdariffa (red sorella)	*Malvaceae*	Seeds	Unknown
Hylocereus undatus (dragon fruit)	*Cactaceae*	Fruit foliage	Unknown
Inga edulis (ice-cream bean)	*Fabaceae – Mimosoideae*	Leaf	Unknown
Jatropha curcas (physic nut)	*Euphorbiaceae*	Seeds	Unknown
Lens culinaris (lentils; pulse)	*Fabaceae*	Seeds	Unknown
Mangifera indica (mango)	*Anacardiaceae*	Seeds	Anionic*
Manihot esculenta Crantz syn. M. utilissima (tapioca sago)	*Euphorbiaceae*	Roots	Unknown
M.oleifera (drumstick)	*Moringaceae*	Seeds	Cationic
Mucuna sloanei (mucuna bean seed)	*Fabaceae*	Seeds	Unknown
Opuntia ficus indica (nopal)	*Cactaceae*	Mucilage	Anionic & neutral*
Parkinsonia aculeate	*Fabaceae*	Seeds	Cationic
Phaseolus angularis (red beans)	*Fabaceae*	Seeds	Cationic
Phaseolus mungo/Vigna mungo	*Fabaceae*	Seeds	Unknown
Phaseolus vulgaris (common beans; kidney bean)	*Fabaceae*	Seeds	Anionic
Phoenixdactylifera (date palm)	*Arecaceae*	Seeds; pollen grains	Unknown
Plantago ovata (psyllium Indian)	*Plantginaceae*	Seed	Cationic
Pleurotus tuber regium (king tuber mushroom)	*Pleurotaceae*	Sclerotium	Unknown
Pistacia atlantica	*Anacardiaceae*	Seeds	Unknown
Pisum sativum (Pea)	*Fabaceae*	Seeds	Unknown
Prosopis juliflora (mesquite)	*Fabaceae*	Seeds	Neutral*
Prosopis laevigata (smooth mesquite)	*Fabaceae*	Seeds gum	Neutral*
Prunus armeniaca (apricot)	*Rosaceae*	Seeds	Unknown
Red maize	*Poaceae*	Grains	Unknown
Quercus robur (common oak)	*Fagaceae*	Seeds	Unknown
Quercus cerris (turkey oak)	*Fagaceae*	Seeds	Unknown
Quercus rubra (Northern red oak)	*Fagaceae*	Seeds	Unknown
Robinia pseudoacacia (black locust)	*Leguminosae*	Seeds	Unknown
Strychnos potatorumLinn (nirmali)	*Loganiaceous (Strychnaceae)*	Seeds	Neutral
Scaphium scaphigerum (Malva nut or Taiwan sweet gum)	*Sterculiaceae*	Seeds	Neutral*
Tamerindous indica (tamarind)	*Fabaceae*	Seeds	Neutral*
Trigonella foenum (fenugreek)	*Fabaceae*	Seeds	Neutral*
Vigna unguiculata	*Fabaceae*	Seeds	Cationic
Zea may (corn)	*Poaceae*	Grains	Neutral

Natural coagulants are polymers with varying characteristics such as configuration, MW, and charge. Configuration of the polymer indicates to the physical arrangement of monomers along its backbone and is either linear, branched, cross linked, or in a network Most natural coagulants are either linear or branched. MW is a substantial

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parameter for polymers used in water treatment with high MW being helpful for destabilization through the bridging mechanism. There is however a practical upper MW limit decided by the difficulty of dissolving polymers with MW over 10^{7} g/mol[18]. **Fig.3:**is the configuration of different polymer shapes. Natural coagulants can either be cationic, anionic, poly-ionic (amphoteric or ampholytes), or non-ionic (neutral) based on if their net molecule carries a charge [19].The charge of the plant-based polymers is to a large degree still unknown.

Table 2. The Purpose forusingOak as natural bio- coagulant.

(Why Natural Coagulant**)**

1- It is natural fully non-toxic biodegradable. 2- alongside levels of outflowing allevation, it further more minimizes the level of microorganism in water.	**N**atural **C**oagulant	3- The Oak seeds extraction possess natural buffering capacity so: no pH alkalinity adjustments are required.

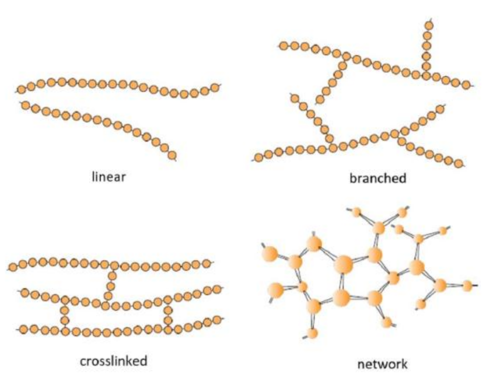

Figure 3: Configuration of different polymer shapes[20].

Water types often used in drinking-water treatment (bentonite and kaolinite clay solutions) and wastewater effluents are used as coagulation medium for reported particle extraction. As we all know, water from rivers to homes is especially turbid during the rainy season. River clay is suspended in water and carries with it solids, bacteria, and other microorganisms. Expel as much suspended material as possible before and after disinfection. Adding A controlled treatment procedure using coagulants in raw water Aluminifers and synthetic polyelectrolytes are either unavailable locally or imported with foreign currency. Natural coagulant: crushed oak leaf seed Seeds may dry on the tree before harvest. Shelled, crushed, and stitched seeds make oak flour. Proteins and seed powder generate a net positive charge. Most dosing solutions are 1-3%. Now it's a natural cationic polyelectrolyte. In this research, the coagulants and coagulant aid were procured, equipment was prepared, coagulation-flocculation was

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performed, and the performance of COD, TSS, and colour was evaluated. Egypt's Belbeis (Sharkia) drainage. The total outflow into Belbeis drain is 1.300.000 m3/d from two sources: (1) Berka WWTP with 300,000 m3/d wastewater flow and (2) Gebel El-Asfar Drain with 1.000.000 m3/d wastewater flow. The items were sealed and delivered to the lab in a classified thermal reticent plastic container. Samples were kept refrigerated at 40C to avoid microbial deterioration. The necessary quantity was removed from the stock when it reached room temperature (25–300C), depending on its characteristics and chemical qualities. A new 500 ml was used in jar testing 22. pH, TDS, TSS, BOD, COD, turbidity, colour, and temperature were measured. This book's objectives were to reduce water turbidity by using a local natural coagulant and making the treatment procedure more eco-friendly. Reduce smell and detoxify harmful chemicals in Acorn leaves draining water for reuse (COD, BOD, TSS, TN, TP and ammonia). Coagulation is a process that converts small particles into large ones. by adding a coagulant to enhance particle operating size (flocks) and settling rates, or by destabilisation Initially, the water/wastewater colloidal particles are in phase. A neutral mixed compound is created by adding divalent positive-charged chemcial chemicals to colloidal particles. A coagulant supplement should also help stabilise colloidal particles, avoiding particle clots. Different coagulants destabilise colloidal particles in different ways 26–26. Colloidal particle destabilisation is divided into four (4) methods: two-layer stress, sweeping flocculation, load neutralisation, and inter-partisan bridging. Coagulation is used to change these particles so they can cling together. Most colloids used in water treatment are suspended in solution due to their net negative surface loads. The coagulant balances the load such that the particles form large particles that can be readily recovered from wastewater..

Table 3: Analyzed results of a sample from Sewage drainage

Parameters	**Values**	**Parameters**	**Values**(mg/l)
pH	7.6	Boron	<0.004
Turbidity	52.20 NTU	Na ppm	120
Colour	green yellow		
Temperature ^{O}C	23	K ppm	24
Total dissolved solids (TDS)	2710 mg/l	Barium	0.04
TKN	13.03 mg/l	Cadmium	<0.0007
Total Phosphorus (TP) mg/l	0.42mg/l	Cobalt	<0.002
Ammonia	6.7mg/l	Chromium	<0.01
EC	1555 µS/cm	Copper	0.02
Sulfate (SO_4)	295 mg/l	Fe	<0.02
Nitrite	0.05 mg/l	Aluminum	0.02
Oil &greases	14 mg/l	Mn	0.02
Chlorides as $(Cl)^-$	960mg/l	Molybdenum	<0.002
BOD (O_2 /L)	28 mg/l	Nickel	<0.001

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TSS	155mg/l	Lead	<0.008
/L)	82mg/l	Vanadium	<0.02
Nitrate	0. 25 mg/l	Zinc	0.04
TN	13.33 mg/l	Cyanide	<0.001
E. Coli (MPN/100ml)	2.1 x 10	Phenol	<0.001
Fecal Coliform (MPN/100ml)	3.6 x 10	D. Sulfide	1.4

2. Methodology

2.1. Experimental design

Different equipment and reagents are required to evaluate the physical and chemical characteristics of the river water using standard techniques, methods of collection, preservation, description and analysis of material prior28,27. The following equipment was used: funnel separators, filter papers, tubes for testing, drying oven, thermal resistant plastic containers, stirring machines with six paddles or magnetic stirring machines, 100 push-pull syringe pumps, specrophotometers with Fourier Transform Infrared (FTIR), Standard 2130B for (Turbidity), USEPA Method 8000 for (Turbidity) (COD). The USEPA colour measurement method 8025 was used to detect functional groups, analytical balance, stopwatch, desiccating devices, digital reactor blocks (DRB 200), APHA Standard Method 4500 pH metre, DAIKI Sciences SHAKER Standard, aluminium weighing devices, CILAS Particle Size Analyzer weighing scale, pipet weighing device and floculation device. The organic matter content and the total hardness of alkalinity were specified according to conventional titrimetric methods. Fig 4: is a picturesque perspective of some equipment utilised. Acetic acid, sulfuric acid, sodium hydroxide, potassium dichromate, aluminium sulphate, ferric chloride, powder and distilled water were the reagents used in this study.

Fig.4. Lab equipment's used

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Field multimeter Multi Conductivity/temperature sensor
(WTW – Company, Germany)

2.2. Wastewater sampling

The study started with wastewater samples from a Bilbeis drain near Zagazig, Bilbeis-Qalubeya. Table 2 summarises the sample's major features. Figure 5 shows a picture of Bilbeis drain wastewater. The material was labelled, sealed, and sent to the lab. Sample kept at 40C to prevent microbial degradation29. The protected specimen was allowed to reach room temperature (25–30 oC) and was examined for its physical and chemical properties before the experiment. 30 Jar tests were performed on fresh wastewater 500 cc. The factors studied were pH, TSS, BOD, COD, organic content, oil & greases, turbidity, colour, and temperature.

Fig.5. A photographic to a sample of wastewater from a Bilbeis drainwith turbidity 52.20 NTU

2.3. Preparation of Natural Coagulants (Oak leaves)

The coagulant was formerly obtained by the following series of procedures as powder from the Oak leaves: Oak leaves are purified, tap water rinsed, dried for 24 hours at 100C, powdered and seven in a 300µm sieve of 33,32,31. In all Jar Test testing tests, the proportion with particles less than 0.35 mm was utilised to ensure full solubility of

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functional components in the seeds. All the procedures required to produce the Bio-Coagulant were illustrated in Fig.6,7, however the stages were described in depth in Fig.7. Distilled water has been added to the powder seed to get 1% suspension and then stir for 45 minutes using a stirrer to increase water extraction for coagulant proteins and HCl (0.025; 0.05 and 0.1M), NaOH treating (0.025; 0.05 and 0.1M) and finalizing with NaCl therapy (0,25; 0.5 and 1M). Solution must shake thoroughly before using it.

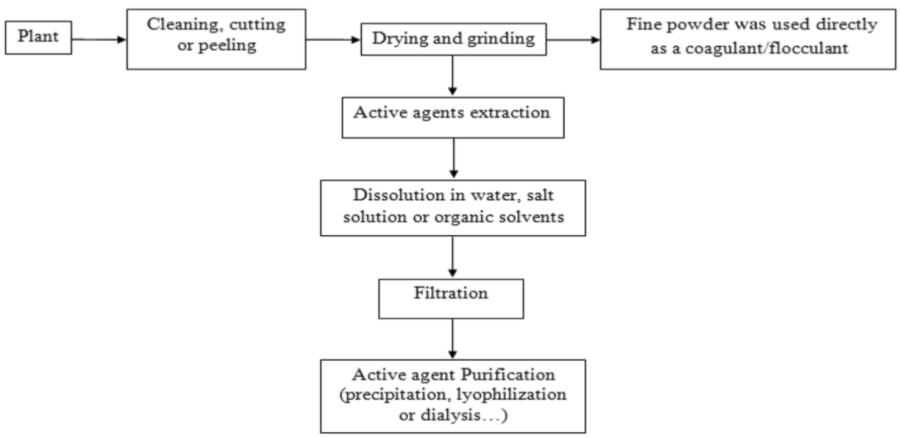

Fig.6. General diagram indicates How bio-coagulant/bio-flocculant prepared.

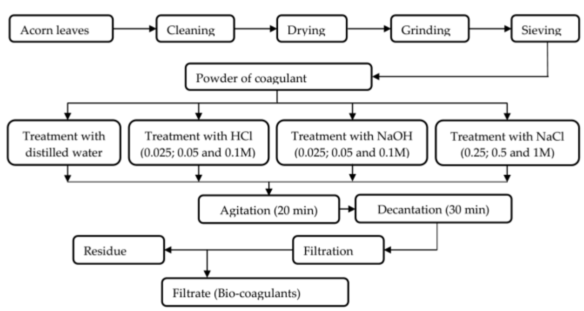

Fig.7.A Diagram Shows steps of Preparation of Natural Coagulant (Oak)

2.3.1. FTIR Analysis of Oak Leaves

spectrophotometer FTIR was utilised to identify functional groups that captured oak leaf spectra. A few oak leaves (1.0mg), crushed and pelleted (100mg KBr). Four-cm-1 resolution was used to analyse the pellets generated in the frequency range 4000-400 cm 1. Oak leaf spectrum (Figure 8). The strong extend at 3402.2 0.1 cm1 shows the impact of OH stretching bounding vibration. CH groups 2927.7 and 2858.3 cm1 were found. C cinemaN and C cinemaC bands be typical of 2364,6 ± 0,1 and 2148,6 ± 0,1

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cm −1, respectively. the carboxylic elongation vibration C=O function (ester groups) specified to the band at 1743.5 ± 0.1 cm^{-}

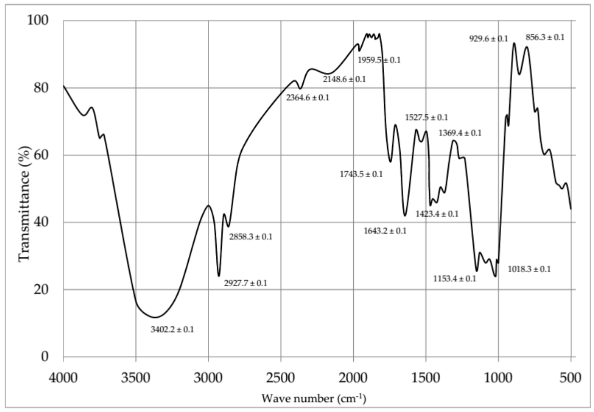

Fig.8 Infrared spectra of Oak leaves

2.4. Coagulation procedure (Jar Test experiment)

Coagulation-flocculation is the best method used in the sewage treatment plant because of its impact. 38,37

The purified Oak seed extract obtained optimum removal efficiency and an optimal elimination performance of 92.3%. Fig. 9: Shows the stages of flocculation. Both the natural polymers have the properties to operate across a broad pH and do not convert the pH of the treated water. The removal of particles in water treatment is regulated according to the turbidity parameter. The turbidity/particle extraction method by Oak is established to be charging neutralisation, bridging, electrostatic stain removal and spreading, Fig. 10. (Natural polymers such as polyelectrolytes operate and are composed of a variety of charged and functional groups, such as –OH, –COOH and –NH2. Coagulation includes bridging, charge neutralisation and coagulation of spread and compression of the electric dual layer of charged colloidal particles 39. Carbohydrates, proteins and lipid macromolecules are usually components of bio-coagulants. The main ingredients of polymers used in wastewater treatment are polysaccharides and amino acid 40. Other operational coagulants across anionic contaminating particles include polyelectrolytes with cationic charge. The presence of charge on both polymer and contaminated particles creates electrostatic attraction and dense pollutant particles significantly absorbed while achieving a balanced reversal of charges from the outer surface of polluted particles. Next neutralisation these particles come into touch and create flocks which may readily be cleaned 41 Polyelectrolytes with high load density may better load particles. On the surface of a pollutant, polyelectrolytes with higher cationic and lower anionic load density. This process removes colloidal particles from water and restricts their movement via coagulant precipitation. Hazardous chemicals are removed.43. This technique works in chitosan wastewater treatment. The major elimination mechanisms for turbidity in a soil with a

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negative pH are load neutralisation and bridging44.. Jar Test Appliances (Four/six Stirrers 5 - 150 Rpm, Electronic, 230V, 50Hz, 100W, 25 to 200 rpm range) The jar test is a widely used technique to achieve and optimise the clotting method – flocculation based on conventional methodologies. 45, the 1000 ml(1 L) beaker was filled with 300 mL of raw wastewater to carry out this experiment, while the usual jar procedure was followed at a constant air temperature of 25 oC. Each beaker agitated throughout the coagulation phase, including 1 minute rapid mixing (160 rpm), followed by 10 min gradual mixing (30 rpm) for 15 min for flocculation. After 1 hour of settlement, the surnatant was filtered through a robust filter paper (0.45 microns) for filtrate removal from the active coagulant. This filtered solution was used as a dosage of bio-coagulants in Jar Test studies, in order to avoid any impact, such as viscosity, coagulation and pH alterations, the solution should be available and maintained in a cooler every day. Before using it, the solution must be shaken thoroughly. After sample settling, a surnatant volume was taken from the surface of the beaker at a distance of 5 cm, to identify the optimum pH value turbidity and other water quality characteristics, tests were conducted in pH range (2-9). Different concentrations of coagulant potion, which ranged from 10 to 80 mg/l, were used to treat increased efficiency with increasing levels of potion. The input factors of the coagulant dosage and pH were the following: electrical conductivity, organic matter. content and total alkalinity hardness.
The removal efficiency of turbidity and color (TRE) was calculated using Eq. (1) as follows:

$$\text{TRE}\ (\%) = \left[(T_0 - T)/T_0\right]100 \quad (1) \qquad \text{(or)} \qquad \text{Efficiency}\ (\%) = \frac{\text{Value (control)} - \text{(sample)}}{\text{Value (control)}}$$

where T_0 and T represent the initial and final turbidities (NTU) of water, respectively.

Fig.9: Shows the coagulation-flocculation steps**: (b)** Indicates floc formation through coagulation by Oak Leaves: **(c)**Stabilized flocs after 10 min settlement and **(d)** forming of massive flocs.

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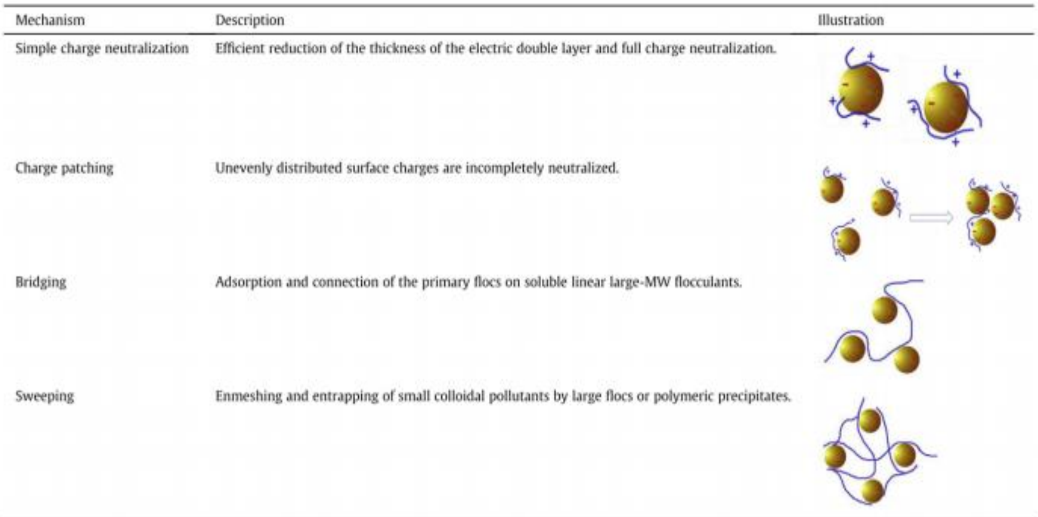

Mechanism	Description	Illustration
Simple charge neutralization	Efficient reduction of the thickness of the electric double layer and full charge neutralization.	
Charge patching	Unevenly distributed surface charges are incompletely neutralized.	
Bridging	Adsorption and connection of the primary flocs on soluble linear large-MW flocculants.	
Sweeping	Enmeshing and entrapping of small colloidal pollutants by large flocs or polymeric precipitates.	

Fig.10. Coagulation/flocculation mechanisms reported for Biopolymer Oak. [39]

3. Results and Discussion

This manuscript examined natural coagulants and its healthy effect on lowering turbidity from wastewater than other organic coagulant which causes various diseases. The results acquired are existing in Five divisions: Investigation of coagulant dosage and its Efficiency for turbidity removal, effectiveness of mixing time, the influence of Agitation speed, the effect of temperature and finally the effect of pH.

3.1 Optimum dose of pH for turbidity removal

Parameter The pH is very important to improve the efficacy of coagulation There have been more than one set of jar experiments to assess the effect of pH on turbidity and COD efficient removal Fig 11: shows the pH effect on the adequacy of turbidity removal46. With reference to the data analysis given in the figure, the optimum pH for the greatest effectiveness of turbidity removal is provided between (2 – 9) It is important to study the impact of pH on the coagulation process since the solubility of the particles and materials depend on the pH value of water. Displays turbidity removal, COD and various pH values (2- 9). Natural coagulation activity in generated water is strong at pH (5). Efficiency of elimination of contaminants decreased when the pH was greater than 5. This decrease was caused by the concentration of OH−ion, which was high enough to compete in the adsorption process with organic molecules from generated water. Also, if the pH value was high, the load of kinds of coagulants was less positive and less appealing to the anionic organic compounds. The pH of water affects the surface load of oak particles in the solution. This phenomena may be explained.

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Fig.11. Optimal pH dosage for elimination of turbidity

3.2 Optimum coagulant dosage investigation

Turbidity is an important indication to be addressed, since it is a clearly observable characteristic. Clear water increase percent (percent close to 100 percent means the preferable treatment results). 47 natural coagulant (Oak) jar tests have been conducted with various concentration dosages (10–80 mg/L) to identify the optimal dose for effectiveness turbidity reduction. Fig.12: indicates the effect of the natural coagulant doses on the efficacy of turbidity removal, it is obvious that turbidity is reduced by raising the natural coagulant dosage at an optimal dose. In addition, excess in doses causes increased removal turbidity, whereas excessive dose causes destabilisation that causes weak (hindrances) attraction between floc and coagulants, which then leads to the decrease of settling speed (destabilisation of colloid particles) as laid down in the Stock Law. COD is the key measure used for access in water and wastewater to organic materials. Fig. 13: It has been established that the dose of chemical oxygen demand (COD) continually rises with the increase in potion due to completely minimal colloid destabilising effects, it has also been found that the organic substance is more readily surrounded by iones with an increase in coagulation ions and less critical to oxidation. Fig. 13: consequently, the removal reducing,the optimal potion is40 mg/L at pH 5for thecoagulant dose which has a significant influence on the elimination competence of turbidity explained by the limitation of transport of pollutant particles to Oak surface, it reached the best removal efficiency TDS= 78.8 mg/l and TSS = 92.33 mg/l and COD 43.4 mg/l by utilizing red Oak.

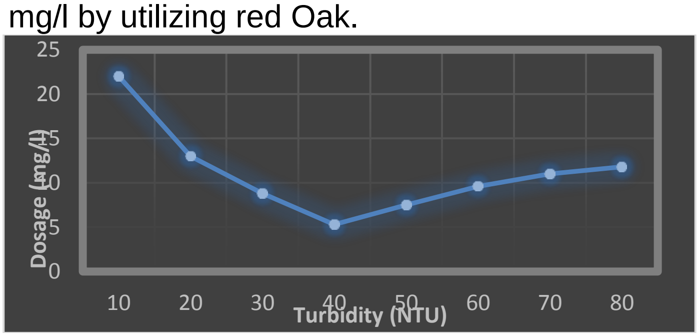

Fig.12. Influence of dose of natural coagulant on the efficiency removal of turbidity.

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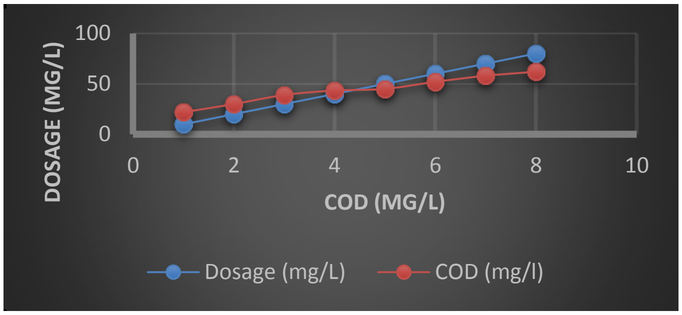

Fig.13. Effect of Coagulant dosage on COD Value.

3.3 Effectiveness of Mixing time for turbidity removalon coagulation process

Fig .14:When the turbidity was 4 NTU, the ideal mixing duration was 180 seconds. On measured residual turbidity during coagulation–flocculation mixing periods of 90-300 seconds 48. The residual turbidity measurement decreases after 180 seconds, showing that faster mixing removes more turbidity (4 NTU). Adding natural polymer to treatment increases floc weight and speeds up suspended particles settling.. The gap in floc sizes at fast and slow mixing speeds was decreased, and the flocs grew stronger as the rapid-mixing period was stretched. Attractive interactions between coagulant molecules and floc particles, such as Vander Waals and electrostatic forces, cause the polymer to attach to the floc particles. High-rate settlers such as tube/plate/lamella settlers may be used in separation, reducing settling time.

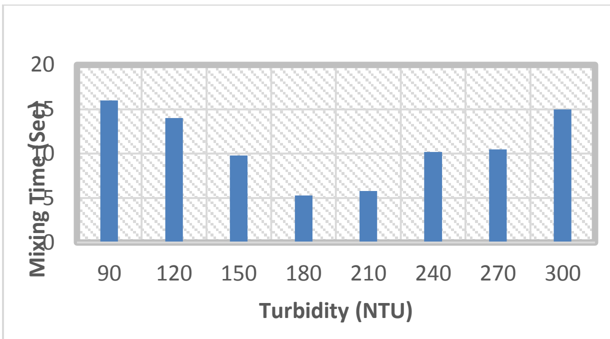

Fig.14. Shows the influence of mixing time on coagulation process.

3.4 The influence of Agitation speed or Mixing speed on Turbidity removal

It decreased turbidity. The faster coagulation speeds up Rapid mixing promotes primary floc particle production in coagulation-flocculation processes. At 160 rpm, longer stirring periods increase flocculation. Because flocs are fragile, a long mixing period is required. So, abrupt motions capable of producing flocs, as well as calm and continuous churning, lose their efficacy51. Rapid mixing was 100-240 rpm, while slow mixing was

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30 rpm. 130 rpm coagulation, then 30 min gentle mixing (30 rpm).

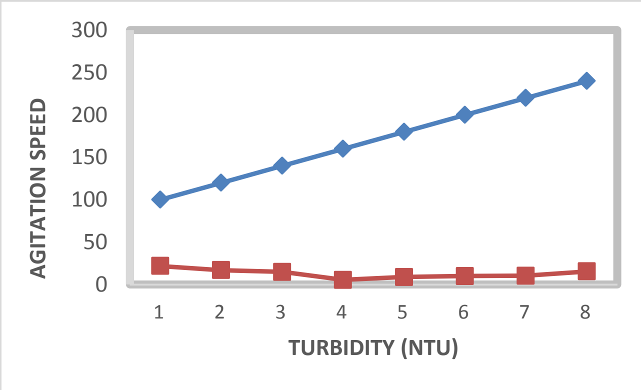

Fig.15. The influence of Agitation speed or Mixing speed on Turbidity removal.

3.5 The Effect of temperature on Coagulation proceed

This will help eliminate the need for chemical reagents in the water, paving the way for a more sustainable environment and clean technologies. Water reuse for the environment and several economic sectors: Based on our findings, agricultural irrigation may benefit both agriculture and water sustainability. • irrigation of public parks, recreation and sports facilities Warmer temperatures promote coagulation. Coagglomeration of coagulants and pollutants occurs during coagulation. Warmer temperatures allow for faster particle movement and more frequent interaction between coagulant and contaminant. 55. Cooled water reduces coagulant solubility, increases water viscosity, and slows particle flocculation. To maximise pollutant elimination, a higher coagulant dosage is needed, and the flocculation time is prolonged. However, the original cost was lower. The treatment procedure will add to the total cost of therapy 56. Increased water viscosity necessitates higher shear stress coagulation (increase mixing speed). Increased shear stress puts greater pressure on flocks designed to disperse pollutants in waste water 57,58. Numerous studies investigated coagulant dosage, pH, and mixing speed 59. However, most study has focused on extrinsic factors like temperature. Some experts think temperature has less impact on pollutant recovery, even though studies show it improves with temperature changes of 60,61. Various studies have found that temperature affects coagulation. This finding needs further study.

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Table 4. Technical parameters with its range

Parameters	Range							
Dosage of Coagulant (mg/l)	10	20	30	40	50	60	70	80
pH	2	3	4	5	6	7	8	9
Agitation speed (rpm)	100	120	140	160	180	200	220	240
Mixing time(sec)	90	120	150	180	210	240	270	300

4. Conclusion

Sewage treatment has become a necessary part of environmental sustainability. there is a wide extent of various ways and technologies ready for the treatment of drainages like our studying (Bilbeis Drain) in Egypt. obviously natural coagulants are extra environmentally friendly while the comparison mentions that natural Polymeric coagulants may replace chemicals in sewage treatment. To assess the ability of Quercus red Oak (Quercus rubra) as a bio-coagulant to reduce turbidity pollutants and TSS in wastewater, which is trendy towards Using natural coagulants from plant, animal, and microbial sources in business promotes 21st century environmental sustainability. Treatment of turbid, heavy metal, and BOD/COD water has been confirmed. Natural coagulants must be investigated to alleviate rural water shortages.. The optimum dose of Oak bio-coagulant is 40 mg/L at pH 5 also TDS= 78.8 mg/l and TSS = 92.33 mg/l and COD 43.4 mg/l. this bio-coagulant reveled motivating outcome powder or distilled water solution, with a turbidity reduction effectiveness of 52.20 NTU to 4 NTU, respectively.

Recommendations

This will help eliminate the need for chemical reagents in the water, paving the way for a more sustainable environment and clean technologies.. Water reuse to necessary collect water for the environment and many commercial sectors: In our research, agricultural irrigation may utilise treated waste water to improve both agriculture and water sustainability. Furthermore the paper highlighted the economic advantages, Uses for water include agricultural irrigation (for both food and non-food crops), pastures, and aquaculture (algal farming)., pollution control and finally in municipal/landscape uses such as irrigation of public parks, recreation and sports facilities.

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