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Analysis of Tamarind Seed Powder in Water Treatment and Purification

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Abstract: *Tamarind is a fruit with a unique sour and sweet taste; it is one of the important foods in the tropics. It is a multi-use and adoptable tree of which more or less every part finds at least some use. Tamarind seed powder was evaluated for it potential to purify water. Water samples from a shallow river were collected, different concentrations and time was analysed. Parameters considered include physical (clearity) and biological (bacterial count), bacteria count that was too numerous before treatment was reduced to manageable levels, especially at level of 2g/500ml to 4g/500ml after treatment with tamarind seed powder. Clearness was also observed at all concentrations used but more pronounced at >2mg/ml. Therefore, it suggested that we can use locally available natural coagulant (tamarind seed powder) to treat the low turbid wastewater which is cost effective and environment friendly.*

Key words: *Tamarind, Purification, Bacteria, & Clear*

Introduction

Tamarind is a fruit with a unique sour and sweet taste; it is one of the important foods in the tropics. It is a multi-use and adoptable tree of which more or less every part finds at least some use (Kumar and Bhattacharya 2008). Tamarind is home-grown to tropical Africa but it is found worldwide in over 50 countries. The main production areas are in the Asian countries, India and Thailand, but also in Bangladesh, Sri Lanka and Indonesia. In America, Mexico and Costa Rica are the leading producers. Africa on the whole does not produce tamarind on a business-related amount (EL-Siddiq et al., 2006).

The history of the use of natural coagulant for the removal of the turbidity is long. Natural organic polymers have been used for more than 2000 years in India, Africa and China as effective coagulants and coagulant aids at high water turbidity. They may be manufactured from plant seeds, leaves and roots (Kuwamura .,1991).In present societies appropriate managing of wastewater is obligation not an option. Historically, the tradition of collecting and purification of wastewater prior to disposal is a relatively recent undertaking. The

treatment of wastewater lagged considerably behind its location. Treatment was considered necessary only after the self-purification capacity of the receiving waters was exceeded and nuisance conditions become unbearable. The rationale behind wastewater treatment is to remove the contaminants from water so that the treated water can meet the adequate quality standards. The quality standards usually rely on whether water will be recycled or discharged into a receiving stream. Wastewaters contains particles with a wide range of shapes, size densities etc, which influence their behaviour in water and therefore, their capacity to be removed. The extent and type of treatment required, however, depends upon the character and quality of both sewage and source of disposal. Water is used for a variety of purpose like drinking washing bathing as well as numerous other varied industrial application, world health organization (WHO, 2011), reports that wholesomeness of water means absence of suspended solid, inorganic solids and pathogens. The report also gives the minimum amount of 25lts (per capital per day) of portable drinking water. About one billion peoples lack safe drinking water and more than six million people (of which two million are children) die from diarrhoea every year (Cheesbrough, 2004). The situation persists and it will continue to cause substantial loss of human life unless it is seriously deal with at all levels in developing countries such as Nigeria, water treatment plant are expensive. The ability to pay for services is minimal and skills as well as technology are scarce. In other to alleviate the prevailing difficulties, approaches should be focus, robust and require minimal maintenance and operating skills. Locally available materials can be exploited towards achieving sustainable safe portable water supply. Drinking water treatment involves a number unit processes depending on the quality of the water source, affordability and existing of guidelines or standards. The cost involved in achieving the desired level of treatment depends among other teams, on the cost and availability of chemicals. Commonly used chemicals for the various treatment units are synthetic organic and inorganic substances.

Most of the chemicals, environmental problems and a number of them have been regulated for use in treatment system. Natural materials can be minimized or avoid their concerns and significantly reduced cost available locally. Generally, it has also been reported by (Murugan and Subramanian, 2006). “Tamarind seed has the potential to be an efficient defluoradating agent in its powder form, for application in domestic and macro level treatment systems, and it is harmless to human”.

Epidemiological studies has consistently demonstrated that consumption of plant-derived food rich in bioactive pythochemicals has a protective effect against oxidation stress (Ovaskainen et al,2008; Galili and Hovav, 2014). Oxidative stress is strongly associated with mutagenesis, carcinogenesis (Abnet et al, 2015) aging and atherosclerosis in humans (Eviratt et al, 2006). The bioactive for the polychemical compounds thus decrease the risk of chronic diseases, cardiovascular disease, cancer and the generative diseases of the aging (Keservani et al, 2010). Currently, industries are interested in developing value added product from the waste- byproduct generated by both the food and agricultural processing industries (Balasudram et al, 2006). The waste product including seeds, peels, stalks, stems and leaves of plant contain substantial amount of phenolics and thus can be used as cheap sources of natural antioxidants for pharmaceutical, cosmetic and food application (Bucic-Kojic et al, 2009). Fruits and vegetables waste product including seed had been reported

gto have higher content of bioactive pythochemicals than the edible portions (Soong and Barlaw, 2004). Fruit seed contains variety of biologically active phytochemicals compounds especially phenolic constituent, flavanoids, anthocyninins, vitamin C, and caretenoids. These phytochemicals positively influence human health and indicate high antioxidant activity (Perez-jimenez et al, 2008). Hence, its considered crucial to increase the antioxidant intake in human diet and one way of achieving this is through enriching food products with seed which are rich in phytochemicals.

Tamarind seed is a by-product in the tamarind pulp industry/. Recently, a large amount of the seed waste is discarded from the tamarind industry (Oluseyi and Temitayo, 2015). Tamarind seed is a rich source of phytochemicals (Tsuda et al, 1994) which consist of phenolic antioxidants such as 2-hydroxy, 3,4-dihydroxy phenyl acetate and epicatechin (Sudjaroen et al, 2005; El-siddig et al, 2006). Tamarind seed extract exhibit antioxidant potential by reducing lipid perooxidation invitro (Tsuda et al, 1994) and antimicrobial activity. Tamarind seed therefore has the potential of providing low cost nutrition.

Sample collection

Sample of untreated water were collected from Gwange River near Lagos bridge area within Maiduguri, Borno state of Nigeria, samples were collected in clean five litres gallon.

Procedure

Fresh ripe fruit of tamarind Indica were purchased from Monday market Maiduguri and cracked to obtain the seeds; the seeds were ground to produce the tamarind seed powder. The powder was sieved using muslin cloth in order to prepare tamarind seed stock solution. Five different cleaned conical flask were arranged and labelled A, B, C, D and E, by using measuring cylinder 500ml of untreated water sample was measured and transfer in to each conical flask, using sensitive weighing balance, 1g to 5g of tamarind seed powder was measured and transferred into conical flask A, B, C, D, and E, and each was shaken well then were covered and allowed for required time.

Preparation of media (plate count agar)

The commercially prepared powder of the plate count agar was weighed 22.5g using sensitive weighing balance and transferred into clean conical flask, one litre of distilled water was added and shakes to dissolve completely by heating to boil in a water bath. The media was then sterilized by autoclaving at 121^0C for 15 minutes and allowed to cool for about 45^0C before pouring into sterile Petri dish and allowed to set.

Total bacterial count

The total bacterial count was carried out using tenth fold serial dilution with normal saline 9ml of the normal saline was dispensed in a sterilized test tube and 1g of the sample was weighed and transferred into in to a sterile universal bottle and 9ml of normal saline is added and shake well, 1ml of the unpurified water was taken using sterile pipette and added to the 9ml of normal saline inside the sterile test tube to make tenth fold serial dilution, then 0.1ml was transferred from the third test tube to a sterile nutrient agar and

separated, this was done till 10^9, it was later incubated at 37^0c for 24 hours, the colony are counted using colony counter and the result was recorded and presented as colony forming unit (cfu).

Results

Table 1: Microbial load and turbidity value of unpurified water sample before purification with tamarind seed powder

Water sample (ml)	Total bacteria count (10^9 cfu)	turbidity
A 500	15	cloudy
B 500	19	cloudy
C 500	13	cloudy
D 500	13	cloudy
E 500	14	cloudy

Table 2: Antimicrobial load and turbidity value of unpurified water sample after purified with tamarind seed powder.

Water sample (ml)	T.S powder (g)	Time (hour)	Total bacterial count (10^4 cfu)	Turbidity level
500	1	24	7.1	Light
500	2	24	4.3	Clear
500	3	24	4.6	Clear
500	4	24	4.3	Clear
500	5	24	4.2	Clear

Table 3: determination of optimum hours for purification

Water sample (ml)	T/S powder (g)	Time (hour)	Total bacterial count (10^4 cfu)	Turbidity level
A 500	2	24	7.1	Light
B 500	2	48	4.3	Clear
C 500	2	72	4.3	Clear

Discussion

Table 1 shows physical and microbial analysis of water sample before purification with tamarind seed powder. Water sample which has been collected at Lagos bridge area from Gwange river has showed the high bacteria count of 19×10^9 cfu. In the table shown, the turbidity of sample was cloudy.

Physical and microbial analysis was done for the taken sample from Gwange River and the results are shown in the Table 2, this table shows the physical and microbial analysis of water sample after five different concentrations was used to treat the unpurified water with tamarind seed, bacteria count that was too numerous before treatment was reduced to manageable levels, especially at level of 2g/500ml to 4g/500ml, and remain unchanged at the level of 5g/500ml after treated with tamarind seed powder. It was reported by (Seeddiq et al, 2006) that tamarind seed showed the best antimicrobial activity against tested bacteria. It was also observed that the initial turbidity was cloudy and became light at 1g/500ml, cleared at 2g/500ml after treated with tamarind seed powder as a natural coagulant, according to Ronke et al,(2016) tamarind seed powder removed 78% of turbidity in the treated water Tamarind seed powder has potential to be an efficient defluoriding agent in its powdered form for application in domestic and macro-level treatment system and it is harmless to human reported by (Murugan and Subramanian, 2006).

The optimum concentration observed range from 2g/500 as additional concentrations yield equal results, therefore, it is more economical to consider minimum concentration.

This research showed the antimicrobial activity as well as capability of tamarind seed powder in wastewater purification, it is observed that the number of bacteria that was numerous before the treatment was reduced to manageable levels, particularly in 2g/500 to 5g/500ml after treated with tamarind seed powder as antimicrobial agent against some bacteria and also the turbidity of the sample became light at 1g/500ml and cleared at 5g/500ml which was cloudy before the used of tamarind seed powder as a natural coagulant.

This investigation has shown both the capability of tamarind seed powder in wastewater purification and antimicrobial activity, it was used and tested as antimicrobial agent against some bacteria that are present in unpurified water sample that has been analyzed and it was found to be effective on some bacteria and it also concluded that tamarind seed powder has the capability of reducing turbidity in turbid water. Therefore, it suggested that we can use locally available natural coagulant (tamarind seed powder) to treat the low turbid wastewater which is cost effective and environment friendly. Therefore, it can be advocated as a harmless for human, safe, highly important and medicinal plant for mankind.

This research recommended that; locally available materials can be exploited towards achieving sustainable safe portable water supply.

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