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Cucurbita pepo Seed Powder Reduce the Turbidity of River Water

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ABSTRACT

The high cost of treated water makes most people in the rural communities to resort to water sources which are normally of low quality and which expose them to waterborne diseases. The main objective of this work is to evaluate the effectiveness of Cucurbita pepo seed powders for the removal of turbidity in river water using Alum as a standard. Water samples were collected from Gara River, Madobi local government area, Kano State Nigeria. Various concentrations of Alum and C. pepo seeds powders were prepared; 100, 200, 300 and 400 ppm. pH, turbidity, Total Dissolve Solids, electrical conductivity, Total Suspended Solids and temperature of the samples were analyzed before and after treatment. Significant reductions ($p<0.05$) in turbidity and pH were observed at various concentrations of Alum and C. pepo seed powders. Temperature and TSS were reduced ($p<0.05$) following treatments with different dosages of Alum. Moreover, C. pepo seed powders were observed to decrease TDS while Alum was observed to increase TDS. This study indicates that C. pepo seed powders might be provide an alternative turbidity reduction capacity in river water due to its availability and low cost.

Keywords: Water turbidity, Plant origin water purifiers, Alum, Gari river water

INTRODUCTION

Access to clean and safe drinking water is a human right; however, the availability of potable water is a major concern in both developed and developing countries [1]. Water treatment offers the benefit of potable water in terms of quality (reduced level of contaminants) and quantity (availability) [2]. The world is facing formidable challenges in meeting the rising demands for safe drinking water supply due to population growth which leads to increase in the pollution of water bodies from several industrial and agricultural activities, as well as drought and competing demands from a variety of users [3,4]. Several chemical coagulants have been used in conventional water treatment processes for potable water production that includes inorganic, synthetic, organic polymer and naturally occurring coagulants [5]. In rural areas, the problem tends to be compounded due to high level of illiteracy, lack of access roads and other social amenities [6]. Such communities depend on low quality water from rivers, ponds and/or streams for their daily life, thereby making them prone to water borne diseases [7].

Aluminium Sulphate (Alum) has been the most widely used coagulant because of its proven performance, relatively easy handling and availability in markets. Recently, much attention has been drawn to the extensive use of Alum. Aluminium, which is contained in Alum, is regarded as an important poisoning factor in dialysis encephalopathy [8]. It is one of the factors which might contribute to Alzheimer's disease [9]. Besides, the use of Alum salts is inappropriate in some developing countries because of the high costs of imported chemicals [10]. The use of natural materials of plant origin to purify water has been practiced for long [11]. The main advantages of using plant-based coagulants as water treatment materials are apparent; they are cost-effective (bye products/waste materials), unlikely to produce treated water with extreme pH and highly biodegradable [12-17]. We aimed to utilize pumpkin seeds powder as a coagulant for the removal of turbidity in river water because it is not harmful to the health, readily available, accessible and affordable, and it requires minimal maintenance and operational skills and to compare with the standard water coagulant (Alum).

MATERIALS AND METHODS

Sampling site

The pumpkin seeds were collected from Yankaba market, Nassarawa Local Government Area, Kano State, Nigeria. Sample water was collected from Gara River, Madobi Local Government Area, Kano Nigeria. The water sample was collected in the sterilized plastic bottles; it was collected early in the morning. The bottle was capped properly. This capped bottle was transported to Biological Sciences laboratories of Bayero University Kano Nigeria.

Preparation of coagulants solution of Cucurbita pepo seeds powder and Alum

The *Cucurbita pepo* seeds pods were split open to obtain the seed kernels, which were allowed to air-dry. Dried seeds kernels were ground into a fine powder using an electric blender. After grinding, 1.0 g of powder was added to 1000 cm^3 of distilled water and then stirred for 30 min using a magnetic stirrer. This milky solution was filtered by using mulching cloth first and Whatman filter paper no. 1 to separate residual seeds particles from the solution [18]. After filtration, various dosages for *C. pepo* seeds powder and Alum stock solutions were prepared at 100, 200, 300 and 400 mg/l respectively.

Jar test

Each concentration (10, 20, 30 and 40%) of *C. pepo* seed powders and Alum was added into eight different conical flasks containing 500 cm^3 of water samples. The solutions were mixed and kept on the shaker for 60 min at 120 rpm and then allowed to settle for 4 h. After sedimentation, supernatants were used for determining the physicochemical using the standard methods [19,20] before and after the treatment.

Determination of water quality parameters

pH and Temperature were measured using microprocessor ATC Pocket size dual pH and temperature meter, Turbidity was measured using Hanna Instrument portable turbidity meter with model Lp2000, Conductivity was measured using portable digital conductivity meter with model WPA CM350, Total Dissolved Solids (TDS) was measured using Portable TDS meter with range 10/1990 ppm (Eutech Instrument Pte Ltd, Singapore), while Total Suspended Solids (TSS) was determined by weighing a Whatman filter paper on weighing beam balance (Gultex medical and scientific England Design, Model FA21044), the water samples were then filtered. The wet paper was then dried in the hot air oven at 103°C to 105°C, after which the filter paper was removed and allowed to cool in desiccators then reweighed. The increase in weight was read and recorded as the total suspended solids in the water samples.

Data analysis

Data for the physico-chemical parameters of the Gara river water obtained was expressed as Mean ± Standard deviation. All the parameters were analyzed by one-way analysis of variance (ANOVA) using GraphPad InStat3 statistical software for window 2006. Values were considered significant at $P<0.05$.

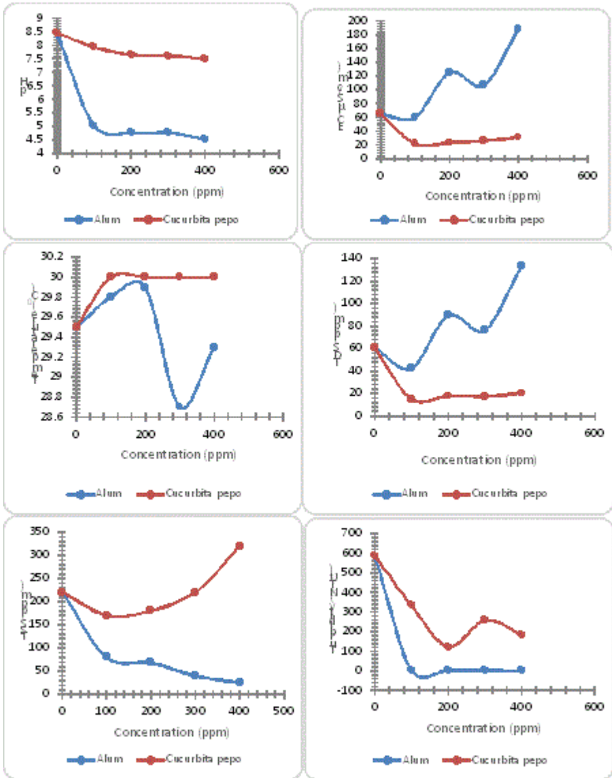

Figure 1: Physico-chemical characteristics of Gara River against five concentrations of Alum and *Cucurbita pepo* seeds powders.

RESULTS AND DISCUSSION

The results for physicochemical analysis were presented above. Figure 1 shows dose depended effects of Alum and *Cucurbita pepo* seed powders on pH of Gara river water. The acidic nature of water treated with Alum could be attributed to its chemical constituent, and this pH falls far below the WHO permissible limit (pH 6.5-8.5) [21]. On the other hand, river water treated with different dosages of *C. pepo* seed powders were observed to give pH that falls within the WHO permissible limit. This may indicate *C. pepo* seed powders to contain bioactive compounds that would accept a proton from water resulting in the release of a group making the solution basic [22]. It is being reported that high basic or acidic water is not suitable for drinking as the body pH must be maintained at 7.4 [23,24].

Electrical conductivity (Figure 1) was observed to significantly increased ($p<0.05$) with increase in the concentrations of Alum during the treatment. However, it decreased significantly ($p<0.05$) with increased in the concentration of *C. pepo* seed powders after treatment. This increase in conductivity by the Alum might be cause by the sulphate ions contained in the treated water [25,26]. It was clear that Alum could increase conductivity, while *C. pepo* seed powder first decreased conductivity and then slightly recovered conductivity. Conductivity values can increase 2-4%, for every 1°C temperature increase. Tap water and portable water in the US were observed to have conductivity of 50-800 and 30-1500 respectively [27].

Mean temperature (Figure 1) of the untreated water was observed to be 29.5 ± 0.10°C, no significant ($p>0.05$) increase in temperature was recorded following treatment with different dosages of Alum except at 300 ppm. A significant increase ($p<0.05$) in temperature was recorded following treatment with various dosages of *C. pepo* seed powders which was however not concentration dependent. The temperature before and after treatments with Alum and *C. pepo* seed powders were both within the range of WHO standard of 27-30ºC. Temperature is an important water quality parameter as it affects the rate of coagulation; the higher the temperature, the more effective the coagulation process [22].

The initial TDS of the river water was observed to be 60.33 ± 0.58 ppm (Figure 1) which was within the standard limits of WHO (500 mg/l). After treatment with *C. pepo* seed powders, the total dissolved solids reduced significantly ($p<0.05$) in concentration dependent fashion. Excess amount of TDS in waters samples indicates poor water quality [22]. It was reported that increase in value of TDS indicated pollution by extraneous sources [28].

Total Suspended Solids of the river water was observed to be 220 ± 0.30 ppm (Figure 1). Following treatment with different dosages of Alum and *C. pepo* seed powders, a consistent decrease in TSS with increase in concentration of both treatments (except at 400 ppm *C. pepo* seed powders) was observed. Total suspended solid in water affects the transparency or light scattering properties of the water. Water is composed of fine clay or silt particles, plankton, organic compounds, inorganic compounds or other microorganisms. These suspended particles size range from 10 ηm to 0.1 ηm, and can be influenced by changes in pH [22]. Suspended solids are the run off pollutants which greatly influence the turbidity of the receiving water which in turn affects the light penetration resulting in reduced photosynthesis [29].

Turbidity of the river water was observed to be 586.67 ± 1.53 NTU (Figure 1), which was beyond the limit as per WHO standards in surface water. In the present study, it was observed that the Alum and *C. pepo* seed powders showed decreased turbidity with increased dosages respectively. Residual turbidity reduces below 5 NTU (WHO permissible value) using different dosages of Alum. The decrease in turbidity using different dosages of *C. pepo* was not within the WHO permissible limits. However, the effectiveness of both treatments was also related to the coagulant concentrations. The turbidity removal using *C. pepo* seed powders was achieved due to the improvement in the flock size which makes the flock to settle rapidly. The overdosing resulted in the saturation of the polymer bridge sites and caused destabilization of the destabilized particles due to insufficient number of particles to form more inter-particle bridges [6]. From the results, it was observed that increase in coagulant dosages led to a corresponding decrease in turbidity. This optimum performance attained could be attributed to the moderate agitation that enhances flocs formation commonly associated with this coagulant [30].

CONCLUSION AND RECOMMENDATIONS

It is evident from this study that *Cucurbita pepo* seeds powder may offer an alternative solution in the reduction of the turbidity of river water to the use of expensive and non-biodegradability chemical coagulants as some synthetic organic polymers such as acrylamide have neurotoxicity and strong carcinogenic effect.

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