

An Ecofriendly Method for Removal of Acidity in Drinking Water

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Abstract: *The presence of mineral acids causes acidity in water. The pH value specified for drinking water lies between 6.5 to 8.5. Water with a pH < 6.5 is acidic, soft, and corrosive in nature. In this study, different types of leaves such as Neem, Guava, Eucalyptus, Coriander, Ficus and curry leaves were used to remove the acidity of water. The curry leaf was found to be very effective for removal of acidity in drinking water among the different types of leaves tried. Curry leaves (Murraya Koenigii Spreng) are natural flavoring agents with a number of important health benefits. The plant is native to India and is usually found in tropic and subtropical regions. They contain various anti oxidant properties and have the ability to control diarrhea, gastrointestinal problems such as indigestion, excessive acid secretion, peptic ulcers, dysentery, diabetes, and unhealthy cholesterol balance. The dried form of the leaf was more efficient than the fresh leaf for removal of acidity in water.*

Keywords: Water quality, Murraya Koenigii Spreng, acidity removal, water treatment

1. Introduction

Water quality refers to the chemical, physical and biological characteristics of water. pH is a critical factor determining acidity or alkalinity of water. pH is the measurement of the potential activity of hydrogen ion (H⁺) in the water sample. The majority of aquatic creatures prefer a pH range of 6.0 – 9.0, though some can live in water with pH levels outside this range. A change in the pH of the water too high or too low, cause the death of aquatic organisms. The pH can also affect the solubility of substances in the water. The extreme pH levels usually increase the solubility of elements and compounds in water [1]. The pH value greater than 11 cause skin problems and pH below 4 cause eye irritation and irreversible damage to skin and organ lining. In addition, pH levels outside of 6.5-9.5 can damage and corrode pipes used for transportation, and other systems.

There are many factors that can affect pH in water, both natural and manmade. Geological formations such as rocks (particularly carbonate form) and other minerals cause the acidity of water. CO₂ is the most common cause of acidity in water [2]. Photosynthesis, respiration and decomposition also contribute the pH fluctuation due to influence on CO₂ levels. As rain fall through the air they interact with CO₂ molecule in atmosphere. This creates H₂CO₃ in the raindrops lowering the pH value [3]. The acid rain requires pH below 5.0. The un polluted rain is slightly acidic (pH=5.6), the pH of the rain can also be lowered due to volcanic ash, sulphate reducing bacteria in wet land, airborne particulates from wild fires and even lightning [4]. Pine or fir can also alter the pH of the soil [5]. The influence of human activity that leads to variation in pH level of water is the acid rain caused by the interaction of rain water with precipitates of nitrogen oxides, sulphur oxides and other acid compounds released during industrial operations, mining activities, smelting operation, fossil fuel combustion etc. Various technologies are applied for purifying water at lower cost and with less energy [6]. There are various studies reported using of plant materials for water treatment [7,8]. Curry leaves are natural flavoring agents with a number of important health

benefits .They contain various anti oxidant properties[9] and have the ability to control diarrhea, gastrointestinal The scientific name of curry plant is 'Murraya Koenigii Spreng' and it belongs to the Rutaceae family. The plant is native to India and is usually found in tropic and subtropical regions. The present works aim to study the effect of curry leaves on acidity removal of drinking water.

2. Materials and Methods

2.1. Collection of acidic water sample

Water sample having pH values lies in the acidic range (3-5) was collected from nearby area in a clean sterilized bottle and the experiment is carried out on the same day.

2.2. Sample preservation

Preservation of sample is done by keeping the sample below 4°C, but not allowed sample to freeze. The sample bottles were opened only during the analysis time.

2.3. Collection and processing of leaves

The leaves were collected locally, cleaned thoroughly with de-ionized water. The dried leaves were prepared by keeping the leaves in an oven at 70°C, until constant weight was achieved. The dried leaves are powdered and sieved into required size.

2.4. Removal of Acidity in water

The experiment was performed in 500 mL glass beakers with 300 ml of acidic water samples. Introduce 100 ppm of individual (fresh and dried form) leaves such as Neem, Guava, Eucalyptus, Coriander, Ficus and Curry leaves to acidic water and allowed to stand for 1 hr. The pHs of water samples before and after the addition of leaves were measured by using digital pH meter of Elico. All the experiments were conducted at room temperature (about 28°C). The variation of acidity of water with respect to amount of leaf, contact time, shaking time etc are

conducted to find out the optimum set parameters and dosage values.

3. Results and Discussion

3.1. Comparison of different leaves for removal of acidity

Effect of six different leaves (Neem, Guava, Coriander, Ficus, Eucalypts and Curry leaf), both in fresh and dry form, for removal of acidity in drinking water were given in figure 1. The initial pH of water is 4.65 and the shift of pH of water with different leaves used was shown in figure 1.

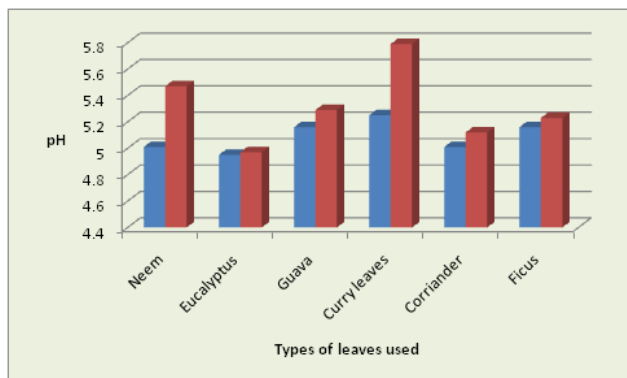


Figure 1: Effect of different leaves on removal of acidity in drinking water (initial pH of water = 4.65, Quantity of leaf in water is 100 ppm, Contact time 1 hour, -fresh leaf, -dry leaf)

All the leaves used were able to shift the pH of the water sample to more neutral region and Curry leaves were found more effective. In all the cases, the influence of dry leaves for removal of acidity was more compared to the fresh leaves. The curry leaf is more efficient compared to other leaves used. The pH of the water sample is shifted from 4.65 to 5.8 by using 100 ppm of dried curry leaf for a contact period of 1 hour. The further studies were carried out with curry leaf only

3.2. Variation in concentration and contact time

Various concentrations of curry leaves ranging from 20 to 1000 ppm were used to remove acidity of water. The acidity removals with respect to various concentrations and also with the contact time were given in figure 2.

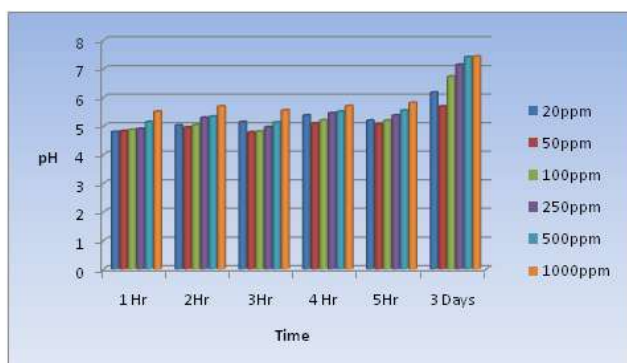


Figure 2: Effect of concentration and contact time of curry leaves with water for removal of acidity

It was found that the rate of acidity removal increased as the concentration of the curry leaves increases. This may be due to the increased rate of adsorption of the H^+ ions on greater surface area of curry leaves. It was also observed that the contact time has a great influence in acidity removal process. As the contact time increases, the pH value also increases due to greater adsorption. After three hours, there was a slight decrease in this effect due to the lack of effective adsorption sites on curry leaves. After 5 hrs the pH value again goes on increasing. This may be due to the action of the chemical component α -pinene present in curry leaves with acidic part of the water sample.

3.3. Effect of shaking time

Effect of shaking on acidity removal of water samples is given in Figure 3.

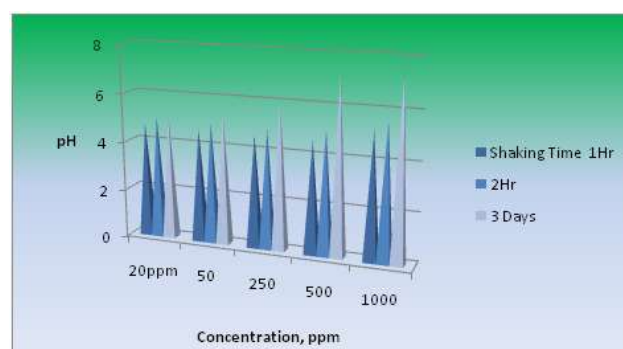


Figure 3: Effect of shaking time of curry leaves with water for removal of acidity

Shaking the curry leaf powder with acidic water showed a notable increase in the pH of the sample. The pH level goes on increasing to the neutral range with the concentration of curry leaves and also with shaking time. This may be due to the increased rate of adsorption on the leaf surface.

3.5. Mechanism of acidity removal

Curry leaf (*Murraya koenigii*) is an important leafy vegetable. The leaves have a slightly pungent smell, bitter, and they retain their flavour and other qualities even after drying. The major constituent responsible for the aroma and flavor has been reported as pinene, sabinene, caryophyllene, cadinol and cadinene. The removal of acidity by using the curry leaf is its adsorption capacity for adsorbing the H^+ ions on its surface and also by the chemical reaction between α -pinene present in curry leaves with the acidic part of the water sample.

4. Conclusion

- Different types of leaves such as Neem, Guava, Eucalyptus, Coriander, Ficus and curry leaves were used in this study to remove the acidity of water.
- The curry leaves was found to be very effective for removal of acidity in drinking water among the different types of leaves tried.
- The dried form of the leaf was more efficient than the fresh leaves for removal of acidity in water

- The pH of the water sample is shifted from 4.65 to 5.8 by using 100 ppm of dried curry leaf with a contact period of 1 hour.
- The pH level goes on increasing to the neutral range with the concentration of curry leaves and also with shaking time
- The removal of acidity by using the curry leaf is its adsorption capacity for adsorbing the H⁺ ions on its surface and also by the chemical reaction between α -pinene present in curry leaves with the acidic part of the water sample.

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