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COMPARATIVE STUDY ON TREATMENT OF WASTEWATER USING VARIOUS TYPES OF NATURAL COAGULANT

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Abstract:

Demand of potable water keep increasing as the population growth. Water has been used in a variety of purposes such as in industries, daily activities and drinking. However, anthropogenic activities have degraded the quality of water and turbidity becomes a major concern in treating surface wastewater. Coagulation is a simple, effective and widely practiced wastewater treatment method. Chemical coagulant conventionally been used in treating turbid wastewater but it may pose adverse effect on human health and environment as well as producing voluminous toxic sludge. This review paper was conducted to determine the potential of natural coagulant to work as effective as chemical coagulant and analyse the coagulation parameter that effect the coagulation activity. A systematic literature review (SLR) which is SALSA method is used to identify, collect, synthesize and analyse data. A total of 10 plant-based coagulant and waste material are determined and demonstrated collectively in this review paper. FTIR spectrum result has verified that natural coagulant contains carboxyl and hydroxyl group which is the important properties in coagulating and flocculating. Turbidity removal efficiencies were verified to be remarkably affected by solvent extractions, pH variations and coagulant dose. Most of fruit peels showed to effectively reduce turbidity using sodium hydroxide (NaOH) as solvent extraction and some of plant-based coagulant worked successfully using distilled water due to plant's active component was water-soluble protein. In this review, most of studied natural coagulants required low dosage to achieve high removal turbidity which was in the range of 0.03-1.0 g/L. Some coagulant can effectively work either in highly acidic or alkaline, also in both or neutral pH. Overall, plant-based coagulant and waste material can potentially behave as chemical coagulant in treating turbid wastewater.

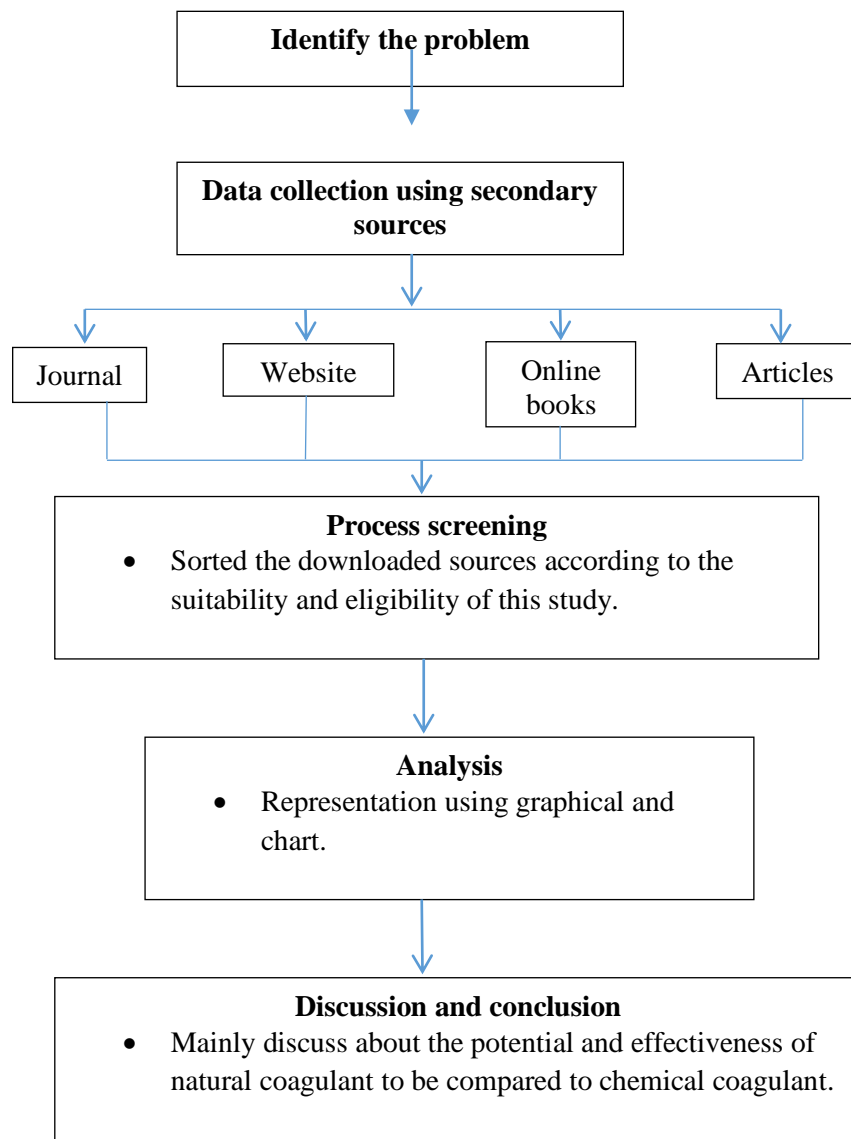
Keywords:

Natural coagulant; Water treatment; Turbidity removal; Coagulation parameter

Objectives:

- To determine the potential of natural coagulant in coagulation of turbid water.
- To study the effect of pH, dosage and different solvent towards coagulation activity.

Methodology:



Results:

Table 3: Effective solvent for extraction of various types of coagulant

Coagulants	Effective solvent
Neem leaves, cactus, <i>jatropha curcas</i> , tamarind seed, cassava peel, roselle seed, pine cone	Distilled water
Acorn leaves, <i>jatropha curcas</i>	Sodium chloride, NaCl
Banana peel, orange peel	Sodium hydroxide, NaOH
Acorn leaves	Hydrochloric acid, HCl

Table 4: Optimum pH condition for selected natural coagulants

Natural coagulant	Optimum pH conditions
Neem leaves, acorn leaves, cactus, tamarind seed	Between neutral pH (7-8)
<i>Jatropha curcas</i> , roselle seed, pine cone	Highly acidic and highly alkaline
Cassava peel	Alkaline, pH 9
Banana peel, orange peel	Acid to neutral

Table 5: Optimized dosage for different natural coagulants

Coagulant	Optimized dosage
Neem leaves, <i>jatropha curcas</i> , tamarind seed, banana peel, orange peel, cassava peel, roselle seed	0.03 – 1.0 g/L
Pine cone, acorn leaves	0.1 – 0.5 mL/L
Tamarind seed, cactus	2 – 3.5 g/L

Conclusion:

Some of the plant-based coagulant and waste material presented in this review paper have shown notable results and could be used either as coagulant aid or primary coagulants. The FTIR spectrum result has verified that plant-based coagulant and waste material contained carboxyl and hydroxyl group which was very important in coagulating and flocculating. Presence of long polymeric chain have strengthened the bridging mechanism between colloidal particles and polymer chain in coagulant. There were several factors that contribute to the coagulation activity for turbidity removal. Among of these were effect of solvent, dosage and pH. From this review, most of the fruit peels showed to effectively remove turbidity when using sodium hydroxide (NaOH) as solvent extraction while plant-based coagulant can worked successfully using distilled water probably due to plant's active component was water soluble protein [43]. Based on this comparative study, most of natural coagulant has shown that low dosage was required to achieve high turbidity removal and coagulation activity as effective as chemical coagulant which was in the range of 0.03 to 1.0 g/L. pH of wastewater also one of the main effects to the coagulation activity. Some coagulant can effectively work either in highly acidic or alkaline and some of them can work actively in both, or also in neutral pH. As pH played a vital role in determining the solubility and dominant surface charges of the active coagulation agents, a balance between the extent of pH adjustment needed and the subsequent turbidity removal efficiencies should be obtained.