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COMPARATIVE STUDY ON TREATMENT OF WASTEWATER USING NATURAL AND CHEMICAL COAGULANT

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Abstract:

The community are facing a serious issue regarding water scarcity due to the exponential population growth. There are various type of wastewater treatment technologies have been developed to ensure plenty of water supply and to meet the demand of clean water for moving towards sustainable development. Coagulation and flocculation processes are commonly used in a wide range of water treatment processes due to its simplicity and cost-effective approach. Chemical coagulants are commonly applied in the coagulation process for turbidity removal. However, it may leads to negative impacts toward health issues instead of natural coagulants. Generally, natural coagulants considered to be more environmentally friendly due to its biodegradability, renewability, non-toxicity and relative cost-effectiveness. This paper was review the effectiveness of natural coagulant versus chemical coagulant and to determine the mixing condition and settling time of the coagulant. The review process conducted based on systematic literature review (SLR) by applying SALSA method which helps to assess both quantitative and qualitative content analysis. This paper highlights the effectiveness of natural and chemical coagulants applied in different type of wastewater. The FTIR analysis proves the potential of natural coagulants in wastewater treatment due to presence of functional group such as carboxyl and hydroxyl group which could help in coagulation process. It was found that, each of the application of coagulants in different type of wastewater have different type of mixing conditions. Based on the evaluation, most of the mixing condition is around 100 rpm. The settling time for coagulation and flocculation show variation due to the different type of coagulants and wastewater. In general, it shows that the turbidity removal increases as the settling time increases. Based on the review, it can concluded the application of natural coagulants are feasible and reliable towards sustainable development.

Keywords:

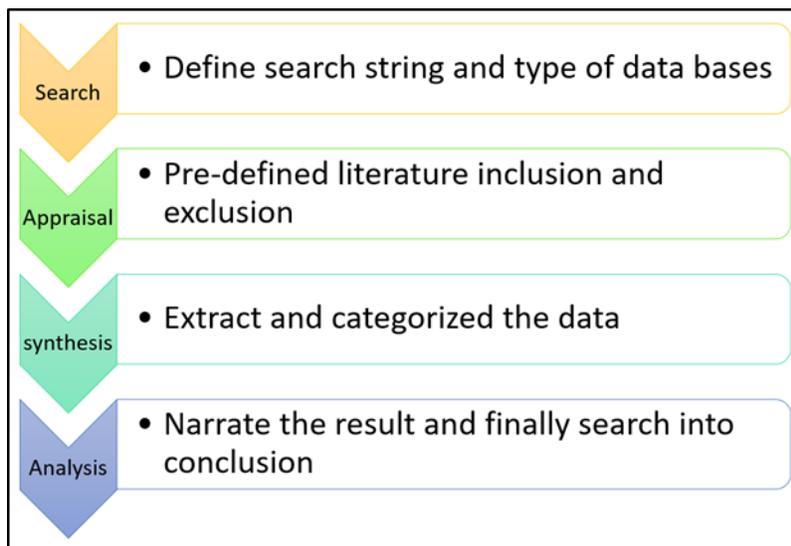
Wastewater, Coagulant, Settling time, Coagulation, Flocculation

Objectives:

- To compare the effectiveness of natural coagulant versus chemical coagulant.
- To identify the functional group in natural coagulant via FTIR analysis
- To compare the mixing condition and settling time of the coagulation

Methodology:

This review study was performed to collect articles in notable journals which provide crucial insights to researchers studying on the comparative study on treatment of wastewater using natural and chemical coagulants.

**Results:**

Efficiency of chemical coagulants

Coagulant	Wastewater	Turbidity removal (%)
Aluminium sulphate (Alum), $Al_2(SO_4)_3$	Kaolin suspension	99
Ferric Sulphate, $Fe_2(SO_4)_3$ Aluminium Chloride, $AlCl_3$	Kaolin suspension Clay	98 99.5

Efficiency of natural coagulant

Coagulant	Wastewater	Turbidity removal (%)
Dragon fruit foliage	Concentrated latex effluent	99.7
Banana peel powder	Raw municipal wastewater	59.6
Mango peels	Raw water	92.7
Banana peels	Raw water	85.4
Orange peels	Raw water	78.9
<i>Moringa Oleifera</i>	Kaolin suspension	84
<i>Cicer Arietinum</i>	Synthetic water	95.89

Mixing condition of coagulants

Coagulant	Wastewater	Mixing condition
Guar gum	Leachate	Mixing speed: 79.2 rpm
Liquid bitter	Kaolin suspension	Mixing speed: 120 rpm
Watermelon seed	River water	Mixing speed: 120 rpm

Details of settling time of coagulants

Coagulants	Wastewater	Settling time (mins)	Efficiency
Chitosan	Industrial wastewater	(40-120) 78.93	Turbidity removal: 90.14% Colour removal: 76.20%
Tannin	Municipal wastewater	(2-10) 10	Turbidity removal: 91.03%
Alum-modified cassava peel starch	Raw water	(10-120) 10	Total suspended solid (TSS) removal: 92.75%
Polysilicate magnesium	Dye wastewater	(5-40) 20	Colour removal: 94%

Conclusion:

In conclusion, the plant-based coagulant is an excellent coagulant for variety type of wastewater treatment process. All of the natural coagulant shows high turbidity removal which is up to 99.7%. The high turbidity removal shows that natural coagulant is the other alternative to replace chemical coagulant which have the downside for human health and environment. Apart from that, these natural coagulants are able to remove chemical oxygen demand (COD), total suspended solid (TSS) and heavy metal. Based on the FTIR analysis, the presence of functional groups such as carboxyl and hydroxyl helps to improve the coagulation and flocculation in wastewater treatment process. There are few factor that will influencing the efficiency of coagulant in wastewater treatment process. The mixing condition is also an important factor in wastewater treatment process. A good mixing conditions will ensure excellent flocs properties. The efficiency of the coagulant can be evaluated based on the flocs condition during the process. The optimum mixing speed for jar test is range 100-120 rpm. The turbidity removal increases as the settling time increases which range 10-80 minutes.