Retraction

Retraction: Surface Water Pollution Study for Chinnandipalayam Lake, Tirupur and Remedial Measure by Wastewater Treatment (IOP Conf. Ser.: Mater. Sci. Eng. 1145 012014)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

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Surface Water Pollution Study for Chinnandipalayam Lake, Tirupur and Remedial Measure by Wastewater Treatment

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Abstract. The dyeing industry is widely recognized as the main source of water contamination. These industries dispose of wastewater in the water bodies along with the solid waste. The physicochemical characteristic of an aquatic body gets affected and estimation of these parameters provides information on water quality and pollution status. Physicochemical parameters like pH, turbidity, chlorides, hardness, total solids, dissolved solids, BOD, COD and sulphates of the surface water samples obtained at different locations near to the Chinnandipalayam Lake, Tirupur were studied to find the influence of the dyeing waste. The water samples collected were treated using natural coagulant and the removal efficiency was studied. The initial pH, Turbidity, COD of the most contaminated sample are 7.95, 21.1 NTU, 666 mg/l respectively. Natural coagulants T.foenum-graecum (Fenugreek), Cicer arietinum (Chickpea), Azadirachta indica (Neem), Moringa Oleifera (Drumstick) and Dolichos lablab (Beans) and also chemical coagulant alum were used in this study and the efficiency of reduction of turbidity using these natural coagulants are 79.6%, 80.1%, 76.8%, 80.6% and 73.0% respectively and of using alum is 95.3%. When using natural coagulant at varying levels, total solids in the sample decreased considerably. At the same time pH and conductivity are not greatly. Moringa Oleifera s output is greater than that of other four; this depends on the protein content in the natural coagulant. but chemical coagulant has treatment efficiency of 95.3%. Even though alum has more efficiency, natural coagulant is eco-friendly and do not affect the environment after disposing the sludge and also the lake water is being used for the agricultural purpose 80% treatment efficiency can be adopted.

Keywords: Dyeing, BOD, COD, T.foenum-graecum (Fenugreek), Cicer arietinum (Chickpea), Azadirachta indica (Neem), Moringa Oleifera (Drumstick) and Dolichos lablab (Beans), coagulation, natural coagulant, correlation.

1. Introduction
The usage of land area within the river basin has greater effect on surface water quality. Water quality may deteriorate land use and the patterns of land cover within the watershed as act increases. Land use affects the water quality through non-point sources, which contribute significantly, and hard to manage surface and spring water pollution. Water pollution is any human-induced water contamination that limits its utility for public and other earthly species. Land use would likely impact the hydrological cycle, both in terms of water quantity and quality. It affects the amounts of runoff, penetration, water quality and watershed vegetation. Surface water bodies like streams, rivers and
reservoirs are not the only sources of waterbodies that suffer from contamination but are also impacted by underground aquifers, which are vital sources of both drinking water and irrigation water.

As a common treatment of cloudy water produced by suspended impurities and colloidal substances like organic & in-organic impurities and biological pollutants, turbidity is the key indicator of the classification of raw and wastewater before the selection of treatment techniques for extracting and processing water of the necessary quality. The usage of chemical solutions is probably the most efficient way to minimize water haziness. However, residuals found in treated water may present a potential danger to people health and the environment [1]. For sample, large volume of radioactive waste and health issues, including Alzheimer's disease spread by leftover aluminium in potable water, may cause secondary environmental pollution problems [2]. Furthermore, leftover monomers in drinking water after artificial polymers have been clarified are known for its neuro toxicity and powerful properties of carcinogen. Consequently, growing understanding of the eco-toxicological and human health impact of in-organic solutions and man-made flocculants has recently centred common people attention and scientific research on environmentally sustainable approach to water and wastewater treatment. One feasible solution could be the usage of plant-derived fibre coagulants. While usage of some plants for water purification is not modern method, the use of natural coagulant solution is predicted to allow safe and environmentally friendly technology to be implemented in water treatment by depend on indigenous and low-cost renewable plant sources. Since solutions are extracted from natural plant products, coagulants form solid effluent that do not pose danger to the eco system and, due to their non-toxicity, it can be treated biologically or dumped as a soil strengthener [3]. Therefore, the use of fibre-based coagulants leads to reduction in chemical effect utilization and corroding action among apparatus. With this context, the aims of this study are to demonstrate the application of the coagulation method using plant coagulants for the treating polluted water and to identify the ideal dosage of coagulants and also its efficacy [4].

1.1 Study Area
Tirupur city, the executive headquarters of Tirupur district is found on the bank of Noyyal River in Tamilnadu state, at 11.1075°N latitude and 77.3398°E longitude. Tirupur can be a prime textile and knit wear centre contributing to India's exports of 90 per cent of total cotton knit wear. The textile industry gives more than six lakh people jobs [5]. The main a part of the living community in Tirupur city depends on groundwater for his or her drinking, domestic and industrial needs.

Andipalayam, the study area, lies between 11.0863°N and 11.0899°N latitudes and 77.3108°E and 77.3120°E longitudes where most of the people depends on lake water and groundwater for their agricultural needs. The lake called as Chinnapidpalayam Lake which is located at 11° 06’14.6” N latitude and 7717°38.4” E longitude near to Andipalayam town. Capacity of the lake is about 5.00 M cu. ft. which occupies the area about 58.00 acres. Before two decades the lake water was utilised even for drinking purposes, but at present the lake is highly contaminated due to improper disposal of sewage and industrial wastewater [6].

2. Materials & Methodology
The procedure adopted for this project research has been the gathering of seeds, the solution preparation of seed extract from the plants, the coagulation analysis to find the most favourable coagulant dosage, the efficacy of the optimum plant coagulant over the synthetic coagulants in polluted water and the impact of coagulants on different water parameters [7]. Materials used for the analysis, sample preparation and the different methodologies used for the research are described in depth below.

2.1 Collection of Natural Coagulant
Good quality seeds were picked which were fresh and were not infected with the disease. The plant seeds of Moringa oleifera (Drumstick), Dolichus lablab (Beans), Cicer aruetinum (Chickpea), Azadirachta indica (Neem) and Trigonella foenum-graecum (Fenugreek) were collected. For the present study the healthy seeds were selected and used to prepare natural coagulants.
2.2 Preparation of Seed Powder
The seeds collected were washed, and then dried for three days in the shadow. The seeds were then crushed and powdered in a food mixer to a medium-fine powder [8]. The powdered seeds were placed in an airtight jar for potential experimental purposes and kept in the refrigerator.

2.3 Preparation of Seed Extract
To achieve solubilization of active component in seed, the seeds were ground to fine powder of size of 400 μm. 4 g ram of plant seed powder was added in 100 millilitres of distilled H2O. The mixture solution was shaken vigorously for half an hour using a 500-rpm magnetic blender to facilitate the extraction of the coagulant proteins by water, and this was then passed via filter paper [9]. New solutions were formulated regularly and kept refrigerated to avoid the effects of aging, i.e., shifts in pH, viscosity and coagulation. Before usage, approaches had been shook vigorously.

2.4 Preparation of Alum Stock Solution
By combining 2 g of alum in 100 ml of distilled water, a 2 per cent solution of alum was prepared. Using a glass rod the material was well stirred. At this concentration the alum was completely soluble. It was well shaken before using.

2.5 Coagulation Study
To establish the optimal dosage of seed coagulant solution for coagulation of polluted wastewater sampling, a series of experiments were performed. The tests for coagulation were performed using the jar apparatus. The test involved mixing at rapid speed of 160-rpm for 1 minute, followed by mixing at slow speed of 40-rpm for 20 minutes and allowing for 30 minutes of sedimentation in a batch process. Five beakers were filled with half a litre of contaminated water and kept on the floc illuminator and mixed for 1 minute at the prefixed mixing speed of 160-rpm. A known dosage of seed extracts (2ml, 4ml, 6ml, 8ml and 10ml) was applied to all beaker at the same time during rapid mixing. After the rapid mixing, the fixed speed of 40 rpm slow mixing was quickly set for 20 minutes and when this was done the beakers were then carefully away from the illuminator and left undisturbed for the settlement. 20ml of the treated sample was collected for turbidity calculation from the centre of the beaker after settling. The dosage that gives the lowest turbidity is the optimum dosage for this particular sample and the coagulant used. Turbidity measurements were conducted using Nephelometric turbidity meter. All tests were repeated twice using all the coagulants. The water quality parameters for the optimum coagulant and chemical coagulant were studied.

3. Results and Discussion
The surface water from five different locations were collected and the samples were tested for its physicochemical parameters like pH, turbidity, total solids, total dissolve solids, BOD, COD, electrical conductivity, hardness, chlorides and sulphates. Correlation analysis was done to the data and significant positive correlations among various parameters were identified which would be helpful to identify the water treatment to be applied. Table 1 shows the physicochemical characteristics of collected surface water samples and Table 2 shows the correlation between each parameters of the surface water quality.

| Property                           | Sample-1 | Sample-2 | Sample-3 |
|-----------------------------------|----------|----------|----------|
| Potential of Hydrogen             | 07.19    | 07.95    | 08.20    |
| Turbidity (NTU)                   | 18.9     | 21.1     | 17.8     |
| Solids (Dissolved + Suspended) (mg/L) | 3300    | 5817     | 3233     |
| TDS (mg/L)                        | 1765     | 1864     | 1788     |
| Hardness (mg/L)                   | 1235     | 1330     | 1185     |
| Chlorides (mg/L)                  | 2996     | 3146     | 083      |
| Electrical conductivity (mS)      | 2.879    | 3.541    | 3.105    |
| BOD (mg/L)                        | 58       | 100      | 78       |
| COD (mg/L) | 281 | 666 | 426 |
|--------------------|-----|-----|-----|
| Sulphates (mg/L) | 1069 | 1321 | 1178 |

**Table 2.** Correlation matrix of the surface water quality parameters.

| pH | Turbidity | Total solids | TDS | Hardness | Chlorides | EC | BOD | COD | Sulphates |
|----|-----------|--------------|-----|----------|-----------|----|-----|-----|-----------|
| pH | 1         |              |     |          |           |    |     |     |           |
| Turbidity | -0.05 | 1            |     |          |           |    |     |     |           |
| Total solids | 0.26 | 0.85 | 1 |     |          |    |     |     |           |
| TDS | 0.49 | 0.85 | 0.97 | 1 |       |           |    |     |     |           |
| Hardness | -0.06 | 0.99 | 0.85 | 0.84 | 1 |       |           |    |     |     |           |
| Chlorides | -0.59 | 0.84 | 0.65 | 0.42 | 0.84 | 1 | | | | |
| EC | 0.59 | 0.78 | 0.93 | 0.99 | 0.77 | 0.31 | 1 | | |
| BOD | 0.70 | 0.67 | 0.87 | 0.96 | 0.67 | 0.16 | 0.99 | | |
| COD | 0.62 | 0.75 | 0.92 | 0.99 | 0.75 | 0.27 | 0.99 | 1 | |
| Sulphates | 0.67 | 0.71 | 0.89 | 0.98 | 0.70 | 0.21 | 0.99 | 0.99 | 1 |

From table 2, turbidity is mainly related to all the parameters and also TDS has significant correlation with electrical conductivity, BOD, COD and sulphates. This reflects the fact that turbidity and TDS of the surface water is strongly related to their contents. Thus, the treatment to reduce turbidity is well enough to reduce the other parameters in the surface water. Therefore, coagulation using natural coagulant and alum is adopted.

**3.1 Optimum Dosage**

Sample 2 is selected for the treatment, which is highly contaminated. Optimum coagulant dosages are calculated by adjusting the coagulant dose. The optimum dosage of *T*.foenum – graecum (Fenugreek), *M*. oleifera (Drum stick), *C*. arietinum (Chickpea), *Azadirachta indica* (Neem) and *D*. lablab (Beans) are 160mg/L, 480mg/L, 160mg/L, 160mg/L and 240mg/L respectively. Alum has the optimum coagulant dosage 120mg/L. Turbidity after the treatment using different coagulants are shown below in Figure 1 to Figure 6. From those results the optimum volume of coagulant can be found as 5.7ml, 3.9ml, 4.2ml, 4.9ml, 4.1ml and 5.7ml for the coagulants alum, *Trigonella* Foenum - graecum, drumstick, *C*. arietinum, *Azadirachta indica* and Beans respectively.

![Figure 1. Coagulant alum dosage vs. turbidity](image1)

![Figure 2. Coagulant T. Foenum - graecum dosage vs. turbidity](image2)
Figure 3. Coagulant C. arietinum dosage vs. turbidity

Figure 4. Coagulant Azadirachta indica dosage vs. turbidity

Figure 5. Coagulant (M. oleifera) dosage vs. turbidity

Figure 6. Coagulant D. Lablab dosage vs. turbidity

Table 3(a). Treatment efficiency

| Coagulant used          | Residual turbidity (NTU) for dose of (mg/L) | Optimal dosage (mg/L) | Efficiency (%) |
|-------------------------|------------------------------------------|-----------------------|---------------|
|                         | 40 | 80 | 120 | 160 | 200 |                   |               |
| Alum                    | 1.5| 2  | 1   | 1.1 | 2   | 120                | 95.3          |
| Azadirachta indica      | 7.8| 6.5| 5.1  | 4.9 | 6.5  | 160                | 76.8          |
Table 3(b). Treatment efficiency

| Coagulant used       | Residual turbidity (NTU) for dose of (mg/L) | Optimal dosage (mg/L) | Efficiency % |
|----------------------|--------------------------------------------|-----------------------|--------------|
|                      | 80  | 160 | 240 | 320 | 400 | 480 | 560 |                |                |                |                |
| T.foenum-graecum     | 7.9 | 6.2 | 5.1 | **4.3** | 4.6 | - | - | 320 | 79.6          |                |                |
| Cicer aruetinum      | 5.1 | 4.2 | 5.4 | 7.8 | 14 | - | - | 160 | 80.1          |                |                |
| Moringa Oleifera     | 8.4 | 7.0 | 7.1 | 6.2 | 4.5 | **4.1** | 5.2 | 480 | 80.6          |                |                |
| D. lablab            | 12.8 | 10.6 | **5.7** | 6.1 | 7.2 | - | - | 240 | 73.0          |                |                |

Tables 3(a) and 3(b) show the turbidity observed for the samples for different coagulant dosages.

From the tables 3(a) and 3(b), optimal dosages and treatment efficiencies can also be found. Where alum gives higher efficiency of 95.3% with optimal dosage of 120 mg/L and in natural coagulant drum stick gives comparatively high efficiency of about 80.6%, for which optimal dosage is 480 mg/L. Samples which give optimal value is selected for further water quality analysis and those values are tabulated in Table 4.

Table 4. Additional quality (treated water)

| Parameters                   | Pre-treatment Values | Post treatment values using coagulant | Alum | T.foenum-graecum | Cicer aruetinum | Azadirachta indica | Moringa Oleifera | D. lablab |
|------------------------------|----------------------|---------------------------------------|------|------------------|----------------|--------------------|------------------|----------|
| pH                           | 7.95                 |                                       | 6.89 | 6.5              | 6.3            | 6.48               | 6.25             | 6.71     |
| Chlorides (mg/L)             | 3146                 |                                       | 178  | 890              | 1640           | 686                | 155              | 2836     |
| Hardness (mg/L)              | 1330                 |                                       | 375  | 575              | 675            | 640                | 395              | 805      |
| Total solids (mg/L)          | 5816.7               |                                       | 350  | 650              | 800            | 900                | 450              | 1350     |
| TDS (mg/L)                   | 1864                 |                                       | 124  | 590              | 480            | 550                | 570              | 750      |
| COD (mg/L)                   | 666                  |                                       | 378  | 391              | 308            | 462                | 294              | 532      |
| EC (mS)                      | 3.541                |                                       | 0.284| 1.49             | 1.39           | 1.42               | 1.43             | 1.40     |

As the turbidity and COD is the major factor for the water quality, percentage of reduction of turbidity and COD are found (Table 5). In all natural coagulants shows more than 70% of turbidity removal, whereas at most 55% of COD removal is achieved while using drum stick as a coagulant.

Table 5. Percentage of turbidity and COD reduction

| S. No. | Coagulants          | % of turbidity reduction | % of COD reduction |
|--------|---------------------|--------------------------|--------------------|
| 1      | Alum                | 95.3                     | 43.2               |
| 2      | T.foenum-graecum    | 79.6                     | 41.3               |
| 3      | Cicer aruetinum     | 80.1                     | 53.8               |
| 4      | Azadirachta indica  | 76.8                     | 30.6               |
| 5      | Moringa Oleifera    | 80.6                     | 55.9               |
| 6      | D. lablab           | 73.0                     | 21.1               |

4. Conclusion

Untreated surface water is characterized by pH 7.95, conductivity 3.541 mS/cm, COD 666 mg/l, total solids 5816.7 mg/l, TDS 1864 mg/l, Turbidity 21.1 NTU and hardness 1330 mg/L. The contaminated water sample was treated using the natural coagulants and alum. The optimum dosage of Alum, T.
Foenum – graecum (Fenugreek), Cicer arietinum (Chickpea), Azadirachta indica (Neem), Moringa Oleifera (Drumstick) and Dolichos lablab (Beans) seed powder as a coagulant were found to be 120mg/L, 160mg/L, 160mg/L, 160mg/L, 480mg/L and 240mg/L respectively and the treatment efficiencies of coagulants are 95%, 80%, 80%, 77%, 81% and 73% respectively. While alum has more capacity, natural coagulant is preferred, as it is environmentally friendly and does not impact the environment after disposal of the sludge. The highest reduction in turbidity and COD with drumstick between these five natural coagulants is found to be 80.6 per cent and 55.9 per cent respectively; hence the Drumstick is more effective in treating contaminated water.

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