

# Textile & Mat Effluent Treatment by Coagulation Process Using *Moringa Oleifera* and *Azadirachta Indica*

Richard #, Oorkalan \*, Punit Gandhi #

K. Ramakrishnan College of Technology \*\*, Department of Civil \*\*, Bachelor of Engineering (Civil Engineering) #, Assistant Professor\*, National Institute of Urban Affairs #, Water and Environment #, Senior Researcher #

**Abstract** - Nowadays many cities like Chennai, Coimbatore are highly polluted and are in demand of water for their daily needs. Especially textile industries produce more pollution. So, we have decided to treat the Textile and Mat Industry wastewater using natural coagulants which are *Moringa Oleifera* (Moringa seeds) and *Indica Azadirachta* (Neem leaves) in the replacement of chemical coagulants. By treating the wastewater using coagulation we have reduced the physical and chemical characteristics which includes pH, Total solids, Total Dissolved Solids, Total Suspended Solids, Turbidity, Chloride content Biochemical Oxygen Demand (BOD) and Total Hardness. The colour of the wastewater solution has also been removed. To remove the odour in the filtrate, it is heated. Hereby the odour has been removed in the wastewater. Using this, the wastage of water and water demand will be controlled, which is the major problem all over the world. This treated water can be used for construction, agricultural and industrial process. The usage of natural coagulants is eco-friendly and pollution free. It is observed that the maximum reduction of the characteristics is obtained after the addition of *Moringa Oleifera*.

**Keywords** – water management, coagulation

## I. BACKGROUND AND INTRODUCTION

- A. **City Outline:** Coimbatore is the third largest city of the state, one of the most industrialized cities in Tamil Nadu, known as **the textile capital of South India or the Manchester of the South India**, the city is situated on the banks of the **river Noyyal**. Coimbatore existed even prior to the 2nd or 3rd century AD by Karikalan, the first of the early Cholas. Among its other great rulers were Rashtrakutas, Chalukyas, Pandyas, Hoysalas and the Vijayanagara kings. When Kongunadu fell to the British along with the rest of the state, its name was changed to Coimbatore and it is by this name that it is known today, in local Tamil language it is also called as Kovai. In the rain shadow region of the Western ghats, Coimbatore enjoys a very pleasant climate all the year round, aided by the fresh breeze that flows through the 25 kms long Palakkad gap.

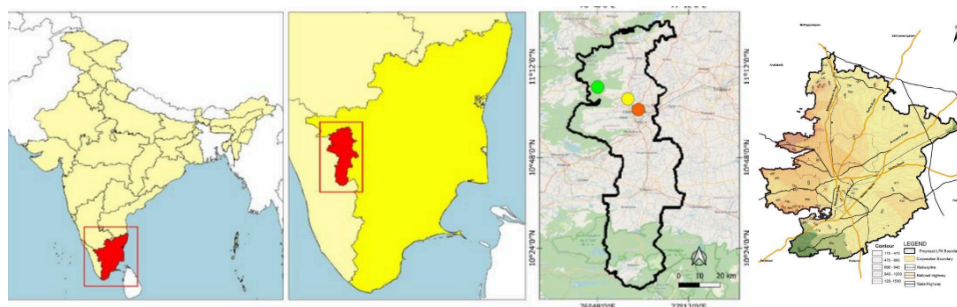


Figure 1: Map of the City  
Source: Wikipedia

- B. **City of textile:** The first textile mill came as far back as 1888 after that many textile mills were started and provided many employment opportunities to within as well as neighbouring Districts. The result has been a strong economy and a reputation as one of the greatest industrial cities in South India. Now, there are more than 25,000 small, medium, large-scale industries and textile mills are situated. Coimbatore is also famous for foundry and automobile industries,

manufacturing of textile industry equipment's, spares, motor pump sets, wet grinders and varied engineering goods and services. The development of Hydro electricity from the Pykara Falls in the 1930 led to a cotton boom in Coimbatore.



Figure 2: Industries in Coimbatore  
Source: Coimbatore Municipal Corporation

- C. River Outline: The historic Noyyal River is originating from the sacred Velliangiri Mountains (a division of the Nilgiri Biosphere Reserve, are located at the Western Ghats Mountain ranges border of Coimbatore in the southern state of Tamil Nadu. The source of Noyyal River being the Vellingiri hills, the holy waters then streams for about 180 km through the districts of Coimbatore, Erode and Karur districts prior to falling into the Cauvery River near Noyyal village. The geographical area drained by the Noyyal River, and its tributaries is specified as **180 km (111.84 mi) long and 25 km (15.53 mi) wide and gets across a total surface area of 3,625.98 km<sup>2</sup> (1,400 sq mi)**. The farming area situated in the Noyyal river basin is figured as 694.98 sq mi and the measurement of population per unit area or unit volume is estimated as 1,000 people per sq km in the urban areas and 120 people per sq km in the rural areas. Keeping the annual rainfall and water of the northeastern and southwestern monsoon season into consideration, the modernization of the Noyyal River Tanks System to manage any condition related to overflow is ecologically crucial.

One of the most sacred rivers of the southern state of Tamil Nadu, Noyyal River was once mentioned as Kanchinadi but later gained its present name which refers to the name of the point where it pours into the river Cauvery. The Coimbatore town was once fenced by the Noyyal River and its channels and streamlets. The storage tanks were a crucial component in refilling the spring water through infiltration of the undersoil body of water. As urbanization developed, the arrangement was disregarded and the number of operational storage tanks was reduced in a drastic manner as only 11 storage tanks were left. Nowadays, the arrangement functions no more and water is deficient when compared with the demand. As a result, farming has significantly reduced and the lacking irrigation water supply impacted in thousands of Coconut trees in the region left to dry up.

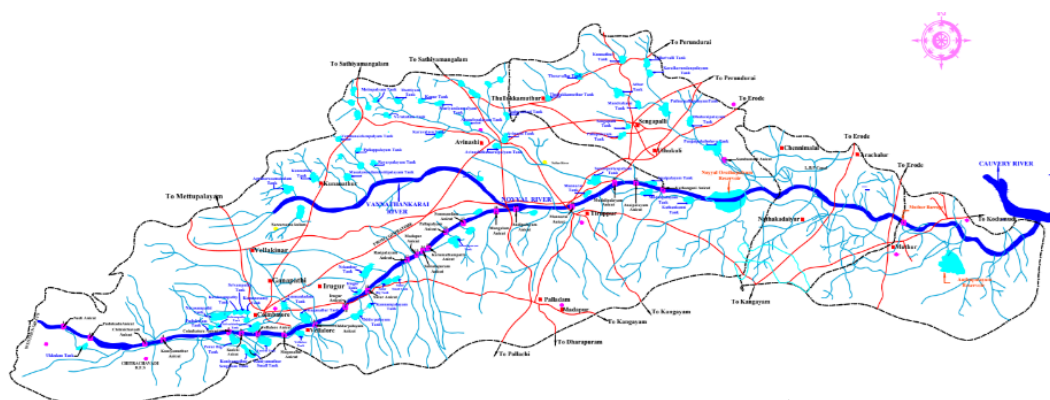


Figure 3: Flow of river through the cities  
Source: TWAD Board Coimbatore

- D. **Current Status of the River:** *The issue raised were Chlorides in the river have reduced the lifespan and reproductive rate of aquatic organisms. Oxygen levels are close to zero, further endangering organisms in the water. Sulphides in the Noyyal are seeping into the surrounding ground water and land in Tiruppur, making the land infertile. According to Dr Nirmala Sadasivam, an in vitro fertilisation specialist, there's a notable increase in cases of infertility among people living along the Noyyal River. Industrial effluents have already compromised agriculture during this basin by grossly polluting each the groundwater and also the water course. Tiruppur's textile trade uses bleaching liquids, soda ash, hydroxide, vitriol, acid, metal peroxide, and numerous dyes and chemicals for its coloring and bleaching processes. Different harmful substances embody variety of dyes, several supported Benzedrine structures or serious metals, each renowned to be toxicant." Most of those chemicals don't seem to be maintained within the finished hose merchandise; however area unit discharged as waste matter. The waste matter is acidic, smells terrible and contains dissolved solids that increase the biological and chemical atomic number 8 demand in water. With no fresh offered for dilution the groundwater from Coimbatore and Tiruppur is not any longer suited to irrigation.*



Figure 4: Current Scenarios of the River  
Source: Wikipedia

- E. **Waterbodies Needs to be Developed:** *Kanchimanadhi, Periyar and Cheyyar are some of the most significant tributaries of Noyyal River. Periyar pours out of the Siruvani Hills and the Kovai Kutralam, an iconic waterfall of Coimbatore. Cheyyar courses through Chaadivayal and along with the other rivers combines at Kooduthurai (also known as Mukkoodal is a sacred place located in Bhavani populated area very close to the Erode district, Tamil Nadu). Subsequently, going through a length of 160 km, Noyyal River connects Kaveri at Kodumudi (a panchayat township in Erode district). This particular location is called as Noyyal. Apart from these three tributaries, there are a lot of other streamlets are connecting Noyyal. Nonetheless, many of the streamlets find water only during showery times of the year. Noyyal River has 23 check dams as well while Aathupalayam Dam and Noyyal Orathuppalayam Dam and Reservoir being the most significant ones.*

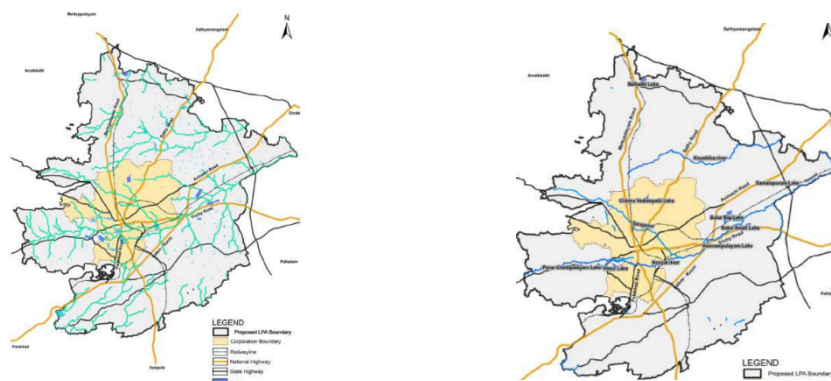


Figure 5: Waterbodies in Coimbatore & Waterbodies needs to be developed ( Left to Right)

Source: TWAD Board Coimbatore

## II. ANALYSIS OF THE RIVER

- A. Wastewater Solution: The wastewater which was collected from the industry was transported to the laboratory. Then these samples were tested for the initial value of the physical and chemical characteristics. The samples were then tested for final value after treatment. The sample of 10 ml solution is mixed with 500 ml of distilled water and mixed with the Moringa and Neem powder of increasing weights by coagulation. The water is then kept undisturbed for 1 - 2 hours for the particles to get settled and filtered using filter paper during which the Moringa powder with dye is removed. The filtered water is analyzed to study the physical and chemical characteristics using appropriate experiments such as pH, Total solids, Total Dissolved Solids, Total Suspended Solids, Turbidity, Chloride content, Biochemical Oxygen Demand and Total Hardness.
- B. Treatment of Collected Wastewater:
- 1) pH: The filtered water of 10-20 ml is taken in a beaker. The pH meter is washed with distilled water and then immersed in the filtered water for 10 seconds. The reading shown in the digital pH meter is noted.
  - 2) Turbidity: The cylindrical glass is filled with distilled water up-to the mark and set to zero by placing it inside the turbidity meter. Then the filtered sample is filled up-to the mark in the cylindrical glass and the reading is noted. The turbidity meter is set to 200 NTU and the reading is noted.
  - 3) Chloride Test: The burette is filled with Silver Nitrate solution. 20 ml of the filtered water is pipette and poured into the conical flask and 5 ml of Potassium Dichromate is added to that. The solution is then titrated against Silver Nitrate solution.
  - 4) Total Hardness: The burette is filled with EDTA solution till zero level. 20 ml of the filtered water is pipetted and poured into the conical flask. Add 2-3 ml Ammonia Buffer solution and 0.2 gram of Erichrome Black T to the conical flask. Then the solution is titrated against the EDTA solution.
  - 5) Total Solids: Take the empty weight of the China clay dish which is  $w_1$ . Using the pipette add 10 ml of the coagulated water to the dish. It is then placed in a muffle furnace which is boiled for 30 minutes at  $550^{\circ}\text{C}$ . The water gets evaporated and the solids remain settled in the China clay dish which is kept aside for some time to cool and then weighed. This is taken as  $w_2$  which is the weight including the dish. The total solid content is calculated by subtracting  $w_1$  from  $w_2$ .
  - 6) Total Suspended Solids: Total suspended solid present in the wastewater is calculated by subtracting total solids and total dissolved solids.
  - 7) Total Dissolved Solids: 10 ml of the coagulated water is being pipetted and filtered using filter paper. The filter paper is then being heated during which the water gets evaporated. Then the filter paper is let to cool and then weighed. By this method the total dissolved solids present in the wastewater is calculated.
  - 8) Dissolved Oxygen: Add 2 ml of Manganous sulphate and 2 ml of Alkaline Iodide - Azide reagent, the pipette tip should be immersed below the liquid surface. Close the bottle and leave it for 5 minutes. Add 1 ml of Concentrated Sulfuric acid and leave it undisturbed for 5 minutes closed. Then take 200 ml clear solution in a conical flask from the BOD bottle and titrate with standard 0.025N Sodium thio-sulphate solution till the colour changes. Add 1 ml starch solution to that which changes the colour. Continue the titration process till the colour disappears. The burette reading is noted.

