

# A Study on Mahi Dam Water Treatment Using Alum, Carbon Activation and Membrane Filtration

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**Abstract –** Water is a basic common asset. Without it, life couldn't exist and individuals couldn't endure. For over 5,000 years, dams have given individuals a dependable wellspring of the water they need to live. In our examination we will learn about the alum, membrane filtration, activated carbon filters and the water treatment process.

**Keywords:** Water Treatment Process, Alum, Carbon Activation, Membrane Filtration

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## INTRODUCTION

Dams have empowered individuals to gather and store water when it is copious and afterward use it during dry periods. Dams have been basic in building up and supporting towns and homesteads just as giving food by water system of cropland. Today, dams and supplies additionally help control rising waters to ensure individuals and property, keep streams safe, give power from sustainable power to towns and production lines, and give sporting open doors, for example, fishing, outdoors and water sports. Today in excess of 40,000 huge dams improve the everyday environments of the total populace that keeps on developing at a pace of in excess of 100 million individuals for each year. However, about 1.5 billion individuals actually don't approach a dependable wellspring of reasonable drinking water and in excess of two dozen nations need more water to appropriately support their populaces. Today more than one billion individuals are malnourished or starving. However, the accessible dams are not used appropriately and squanders from industrial facilities and people are unloaded in it.

Water treatment of these dams are exceptionally needed as water from these dams are provided for family unit utilizes and, in any event, for drinking which whenever debased will cause serious medical problems and even numerous passing are accounted for in view of drinking defiled water. This causes important to give a legitimate water treatment strategy. The water treatment essentially incorporates physical, synthetic, and natural

processes to eliminate physical, substance and organic pollutants. In India, the dam water is generally sullied by different sick conduct of the general population and vacationers who toss trash in the dam and in any event, washing garments, cleaning up, unloading production line trash, and so on Regardless of different laws which confine such deeds in the nation and different usage to clean the surface water, the water is as yet defiled. The main objective of this exploration is to build up a technique which is viable and effective in cleaning the sullied dam water through different strategies. Utilizing cutting edge innovation is presently conceivable to clean the water and make it reasonable for drinking and different purposes. Singapore has actualized an innovation to clean the sewage water and make it worth reusing. Then again, water treatment and re-use engineers need a decent comprehension of a wide range of water treatment processes on the grounds that not all the water treatments are workable for a wide range of surface water as their effectiveness will fluctuate. An appropriate water treatment is required for treating water for which this paper will explore various processes and analyze them over the water accessible at the examination region.

## ALUM (ALUMINUM SULFATE)

One of the first of the few stages that city water providers use to plan water for appropriation is getting it as clear and as sans particulate as could be expected under the circumstances. To achieve this, the water is treated with aluminum sulfate,

generally called alum, which fills in as a flocculant. Crude water frequently holds small suspended particles that are hard for a channel to get. Alum makes them bunch together with the goal that they can settle out of the water or be effectively caught by a channel.

Ordinarily, a combination of water with 48 percent channel alum is infused into the crude approaching water at a pace of 18 to 24 sections for each million. The alum advances coagulation of fine particles which helps settle issues of shading just as turbidity. In the event that the process is given sufficient opportunity to work and is applied appropriately, it remedies issues in the water as well as really brings about eliminating the majority of the aluminum utilized in the process.

Despite the fact that worry over the wellbeing of treating water with aluminum has frequently been voiced, there is no proof that aluminum in water, regardless of whether it comes from the aluminum sulfate utilized in treatment or from different sources, is a medical problem. As a matter of fact, most aluminum that we take in comes from different sources. One examination indicated that just somewhere in the range of 0.4% and 1.0% of our lifetime admission of aluminum comes from alum used to plan metropolitan water. Most aluminum admission is from aluminum that happens normally in nourishments, aluminum utilized in food bundling, and from items like antiperspirants and antibodies.

Water treatment for aluminum is regularly not required, however aluminum is anything but difficult to eliminate with switch assimilation or refining.

There is an assortment of essential coagulants which can be utilized in a water treatment plant. One of the soonest, and still the most broadly utilized, is aluminum sulfate, otherwise called alum. Alum can be purchased in fluid structure with a convergence of 8.3%, or in dry structure with a grouping of 17%. At the point when alum is added to water, it responds with the water and results in emphatically charged particles.

Coagulation/flocculation is a process used to eliminate turbidity, shading, and a few microscopic organisms from water. In the glimmer blend chamber, chemicals are added to the water and blended viciously for not exactly a moment. These coagulants comprise of essential coagulants as well as coagulant helps. At that point, in the flocculation bowl, the water is delicately mixed for 30 to 45 minutes to give the chemicals time to act and to advance floc arrangement. The floc at that point settles out in the sedimentation bowl.

Coagulation eliminates colloids and suspended solids from the water. These particles have a negative charge, so the decidedly charged coagulant chemicals kill them during coagulation. At that point,

during flocculation, the particles are drawn together by van der Waal's powers, framing floc. The coagulation/flocculation process is influenced by pH, salts, alkalinity, turbidity, temperature, blending, and coagulant chemicals.

## MEMBRANE FILTRATION

Membrane filtration, broadly utilized in chemical and biotechnology processes, is as of now settled as a significant method for separating and cleaning wastewater and modern process water. All the more as of late, cylindrical and twisting membrane plants have started to be utilized to channel debasements from savoring water areas where regular treatment ends up being uneconomical.

In spite of the fact that there are various techniques for filtration that join membrane innovation, the most develop is pressure driven membrane filtration. Membrane filtration depends on a fluid being constrained through a channel membrane with a high surface territory. There are four essential weight driven membrane filtration processes for fluid detachments. These are, in climbing request of size of molecule that can be isolated: turn around assimilation, nanofiltration, ultrafiltration and microfiltration.

The utilization of opposite assimilation is grounded for desalination of drinking water and the creation of deionized water for process use. Ultrafiltration and microfiltration, which-not at all like opposite assimilation and nanofiltration-use permeable membranes, are presently getting progressively normal in water and wastewater treatments.

PCI Membrane Systems (PCI MS), situated in Hampshire, England, has introduced various membrane plants in the UK and abroad for both mechanical and city use. Steve Morris, PCI MS's business advancement chief, clarifies the fundamental standards of membrane filtration, "In its least difficult structure, the membrane is utilized to isolate water or process fluid into two sections: the retentate, or concentrate, and the saturate or filtrate." Depending upon the ideal partition, membranes can be utilized either to trap undesirable debasements or to focus materials.

Re-utilization of feedwater is a significant thought in various constant processes, for example, mash and paper make. Recuperation of crude materials likewise is turning into a significant issue. At a main chemical organization in Liverpool, a membrane plant was planned and introduced to recuperate an aliphatic compound from the gushing stream. The recuperated item is reused once again into the process stream, while the CoD of the subsequent wastewater is decreased essentially.

Contingent upon the application, the membranes are fitted inside a lodging of either treated steel or lightweight ABS, as on account of the new C10 ultrafiltration module. The C10 contains a bigger membrane zone than already accessible permitting the utilization of cylindrical ultrafiltration to be more monetarily suitable than previously. In pieces of the water business, the advantages of cylindrical membranes are surely known.

Simplicity of activity, negligible upkeep, disposal of prefiltration and the capacity to self-clean the membranes were all factors that provoked the selection of the Fyne Process in far off areas in Scotland. The Fyne Process eliminates broke down natural solids from drinking water.

Cylindrical membrane filtration is the best option for applications where there are significant levels of solids, thick fluids or where cleaning and upkeep are issues. For higher limit water and wastewater applications, an alternate kind of membrane design is now and then preferred. Spirally-twisted membranes give a higher pressing thickness than cylindrical and are the more affordable option now and again. Notwithstanding, prefiltration is important in light of the fact that the little space between layers in the winding can undoubtedly get hindered by suspended solids. Twisting injury membranes can be utilized across the filtration range.

In Scotland, twisting membranes likewise are utilized in Fyne Process plants where high throughput is required and oneself cleaning ability of rounded units isn't an issue, just like the case at Bunnessan on the Isle of Mull. In different regions of metropolitan treatment, for example, purification, frameworks utilizing empty fiber microfiltration membranes are accessible. This zone of the business is getting progressively significant.

Membrane filtrations perform two assignments, as laid out by PCI MS's Steve Morris. From one perspective they can be utilized to focus or recuperate significant material while the process water is permitted to course through the membrane. Then again, they adequately eliminate foreign substances from squander streams permitting the water to be reused to the process or released to the channel or the waterway.

Ultrafiltration, which regularly works at weights of somewhere in the range of five and 15 bar, is generally utilized in chemical division processes since it can isolate species as per atomic size. Microfiltration notwithstanding, isolates as indicated by molecule size.

Natural membranes treating streams with significant levels of dissolvable or with a wide pH range have been created. Now and again, natural membranes are not reasonable for ultrafiltration, and microfiltration and artistic membranes are utilized.

Albeit capital expense is normally higher, membrane life is regularly more than with natural material.

On account of the variety of utilizations in both mechanical and city water filtration, counseling administrations are accessible to help assess the attainability of utilizing membranes, choosing the most suitable membrane type for each situation. The membrane material, calculation and lodging development all should be thought of. A pilot plant preliminary regularly is fundamental before plant plan and designing is finished. Employing pilot plants for brief periods for on location advancement work is a conservative method of building up the membrane process.

## **ACTIVATED CARBON FILTERS**

Activated carbon filters are for the most part utilized in the process of eliminating natural mixes or potentially separating free chlorine from water, accordingly making the water appropriate for release or use in assembling processes. Taking out organics in consumable water, for example, humic and fulvic corrosive, keeps chlorine in the water from chemically responding with the acids and shaping trihalomethanes, a class of known cancer-causing agents.

Activated Carbon (AC) filtration, similarly as with any water treatment strategy, isn't fit for eliminating each conceivable sort of foreign substance. For instance, sodium, organisms, fluoride, and nitrates can't be eliminated with AC filtration. Water relaxing additionally can't be accomplished with AC filters. What's more, substantial metals, for example, lead, must be eliminated with a quite certain sort of activated carbon water treatment, which is regularly utilized uniquely in private purpose-of-utilization filters.

There are numerous kinds of innovative activated carbon filters accessible for mechanical filtration frameworks. Activated carbon can display fluctuating execution qualities relying on the layers from which it is inferred (e.g., bituminous or anthracite coal, bone singe, coconut shell) and the manner in which it is made. The strategies used to make the different AC materials are profoundly exclusive and lead to particular contrasts across the scope of media accessible to the business. Water Professional can indicate cutting edge filtration strategies for the recognized taints and the degree of virtue required. This is the reason it is basic to coordinate the right activated carbon bed with the specific need. This will accomplish the most proficient separating and the longest use span for the hardware.

Coconut shells and coal (anthracite or bituminous) are both natural wellsprings of activated carbon. Carbon structures when a natural source is singed in a climate without oxygen. This process leaves

just about 30% of the natural mass flawless, driving off substantial natural particles. Before being utilized for water treatment, the natural mass should then be "activated." The process of actuation opens up the carbon's enormous number of pores and further drives off undesirable atoms. The open pores are what permit the carbon to catch pollutants, known as "adsorption". The pace of adsorption for a surface territory of an only one pound of AC is equivalent to 60-150 sections of land.

There are two main enactment techniques:

- **Steam Activation** – Steam initiation is completed utilizing steam at temperatures of somewhere in the range of 800°C and 1000°C. At these temperatures a moment Water-Gas response happens, gasifying the carbonized material. Air is then acquainted with wear out the gasses, without consuming the carbon. This process delivers a reviewed, screened and de-cleaned type of activated carbon. Carbon activated by steam by and large has a fine pore structure, ideal for adsorbing both fluid stage and fume stage mixes.
- **Chemical Activation** – With chemical actuation the carbon is first loaded up with a ground-breaking drying out specialist, ordinarily a glue type of phosphoric corrosive (P2O5) or zinc chloride (ZnCl2). The glue is warmed to temperatures somewhere in the range of 500°C and 800°C to initiate the carbon. Chemical actuation produces activated carbon with an open pore structure, making it more reasonable for adsorbing enormous atoms.

## TREATMENT PROCESSES

### (a) Coagulation

Two coagulants, aluminum sulfate (alum) and ferric chloride (iron), were utilized in container tests utilizing a six-place group stirrer and 2-L glass measuring utensils loaded up with a 1.5-L source water for reactors. Stock arrangements of alum and iron were at first set up in DI at 10,000 mg/L. Coagulant measurements were 40 mg/L (SR-NOM), 25 mg/L (CRW), 35 mg/L (ORW), 40 mg/L (PVW) of alum and 9.4 mg/L (SR-NOM), 5.9 mg/L (CRW), 8.8 mg/L (ORW), 38 mg/L (PVW) of iron. Analyses were performed at pH 5.5 and 8.5 (SR-NOM), pH 5.5 and encompassing pH (CRW, ORW, and PVW) for alum and pH 8.5 (SR-NOM), surrounding pH (CRW, ORW, and PVW) for iron. Blending conditions included 1 min of quick blending at 100 rpm and 20 min at 30 rpm followed by 60 min of settling time. All tests were led at a room temperature of roughly 20° C. Tests were painstakingly gathered and sifted through a 0.7-mm (GF/F) glass-fiber channel preceding LC/MS/MS and GC/MS/MS investigation.

### (b) Chemical Softening

In the chemical softening investigations utilizing calcium hydroxide and soft drink debris, the aggregate, calcium, and magnesium of hardness of the CRW was resolved to be 307, 76.8, and 27.9 mg/L as CaCO<sub>3</sub>, separately. The complete hardness of the ORW was 128 mg/L as CaCO<sub>3</sub>, separately. The pH and alkalinity of the CRW/ORW were 8.2/7.9 mg/L and 140/79 mg/L as CaCO<sub>3</sub>. All the SR-NOM, CRW, ORW, and PVW were analyzed at pH 9 ± 0.2 and additionally 11.3 ± 0.2 in the chemical softening tests despite the fact that SR-NOM water did exclude calcium and magnesium. Stock arrangements of lime and soft drink debris were at first set up in DI at 50,000 mg/L. Softening doses were 52 mg/L (SR-NOM), 213 and 320 mg/L (CRW), 135 mg/L (ORW), and 180 mg/L (PVW) as CaCO<sub>3</sub> of lime and 0 mg/L (SR-NOM), 87 and 170 mg/L (CRW), 41 mg/L (ORW), 30 mg/L (PVW) as CaCO<sub>3</sub> of pop debris, individually. The applied/hypothetical lime and soft drink debris measurements were determined dependent on introductory pH, alkalinity, and carbonic corrosive fixation for abundance lime softening conditions.

Container tests were led to reproduce regular chemical softening processes by utilizing a six-place group stirrer and 2 L glass measuring utensils loaded up with a 1.5 L source water for reactors. Chemicals were quickly added during a fast blend stage (100 rpm) for 1 min and a 20 min moderate blending collection stage (30 rpm) trailed by a 60 min sedimentation stage (no blending). After lime and soft drink debris option, the pH was acclimated to 11.3 ± 0.2 by adding a sodium hydroxide answer for expulsion of magnesium and calcium. The comparative inspecting and examination processes were directed as portrayed for the coagulation tests.

### (c) Powered Activated Carbon Adsorption

Activated carbon adsorption contemplates were led in the research center with two economically accessible brands of PAC, (AC800, Anticarbon, Dunnellon, FL, USA) and WPM (PAC type of F400, Calgon Carbon Corp., Pittsburgh, PA, USA). The PACs were hydrated for 24 hours in refined water before use, and added as a slurry to the examples. PAC measurements were 5 mg/L of AC800 and 1, 5, and 20 mg/L of WPM at pH 7.5 supported with 1 mM phosphate for SR-NOM, and 5 mg/L of AC800 at encompassing pH as well as pH 6.0 cradled 1 mM phosphate and 5 mg/L of WPM at surrounding pH for CRW, ORW, and PVW. The tests were acted in a six-place group stirrer and 2-L glass measuring utensils loaded up with a 1.5-L source water for reactors with a contact season of 4 hours before examining to reenact basic PAC treatment processes in water treatment plants (WTPs). The doses and contact time were applied since some full-scale WTPs that utilization PAC have contact seasons of 1 to 5



hours and apply PAC measurements of 5 to 50 mg/L. Also, examining and filtration methods were followed as depicted for the coagulation and chemical softening. AC800 and WPM were chosen after PAC brand screening tests by the specialists with six distinctive PAC brands tried for the expulsion of bisphenol A (typical plasticizer), 17 $\beta$ -estradiol (common estrogen), and 17 $\alpha$ -ethynyl estradiol (manufactured estrogen – oral conception prevention drug).

#### (d) Nanofiltration and Ultrafiltration

EDCs and PPCPs dismissal tests were done on financially accessible nanofiltration (NF) and ultrafiltration (UF) membranes. The NF (ESNA, Hydromantic, U.S.A.) and UF (GM, Desal/Osmonics, U.S.A.) membranes are slim film composites (TFC) made of sweet-smelling polyamide (ESNA) and made of sulfonated polyether sulfone (PES) covered with an ultrathin polyimide (GM) (as indicated by the production), individually. The membranes have additionally extraordinary pore sizes dependent on their ostensible atomic weight shorts (MWCOs), 200 Daltons for ESNA and 8,000 Daltons for GM, separately. Those membranes have ionizable practical gatherings, for example, carboxylic acids dependent on their zeta possible qualities, - 11.1 mV (ESNA) and - 32.2 mV (GM) at pH 7.5 and conductivity of 300 mS/cm with a NaCl arrangement. Membrane filtration tests were performed at pH 5.8 (DI), 7.5 supported with 1 mM phosphate (SR-NOM), and encompassing pH (CRW, ORW, and PVW).

A business seat scale impasse mixed cell membrane unit (SEPA® ST, Osmonics, Minnetonka, MN, U.S.A.) was utilized to assess level sheet membrane examples. The membrane filtration unit made of treated steel was utilized to limit adsorption of the mixes onto the cell. The entirety of the analyses was performed at a steady introductory unadulterated water transition, 1.2 m/day, a weight of  $677 \pm 39$  kPa for ESNA and  $421 \pm 40$  kPa for GM, and a room temperature of 20° C. The membranes were recompacted for 5 to 7 hours at similar weights with NaCl arrangements. At the point when the motion stayed steady, the feed water was traded. In these tests, an underlying volume of 300 mL of a given example was gone through the membrane until 200 mL of pervade was gotten, and the relating retentate was additionally gathered. The trials were rehashed until a complete volume of 1,000 mL of penetrate was gotten. Expulsion of each compound was determined and flux decline was checked.

#### (e) Chlorination

Tests were chlorinated with sodium hypochlorite (NaOCl, Fisher Scientific, USA) in 1-L glass bottles utilizing DI unbuffered at pH 5.5 and 8.5, SN-NOM (cradled with 1 mM phosphate) at pH 5.5 and 8.5, and CRW/ORW/PVW at encompassing pH (8.2/7.9/6.8) and pH 5.5. Remaining chlorine was

extinguished with ammonium chloride for DI, ammonium chloride, sodium thiosulfate, or ascorbic corrosive for CRW and PVW at a centralization of 25 to 100 mg/L. One CRW test was not extinguished. All SR-NOM and ORW tests were not extinguished. The leftover chlorine in the water tests unquenched was peeled off to the air while tests were being gathered for investigation. The entirety of the chlorination tests was performed at a contact season of 24 hours. Stock arrangements of chlorine were at first set up in DI at 1,200 mg/L. Applied chlorine doses were 1.5 mg/L (DI), 6.75 mg/L (SR-NOM), 3.0 mg/L (CRW), 2.8 mg/L (ORW), and 3.8 mg/L (PVW) as Cl<sub>2</sub>.

#### (f) Ozonation

Ozone tests were directed in 1-L glass bottles by putting DI unbuffered at pH 5.5, SN-NOM (cushioned with 1 mM phosphate) at pH 7.5, and CRW/ORW/PVW at surrounding pH in the presence/nonattendance of H<sub>2</sub>O<sub>2</sub> (0.025 mgH<sub>2</sub>O<sub>2</sub>/mgO<sub>3</sub>). Applied ozone measurements were 1.5 mg/L (DI), 4.0 and 8.0 mg/L (SR-NOM), 3.1 mg/L (CRW), 3.5 mg/L (ORW), and 3.0 mg/L as O<sub>3</sub>. The remaining ozone in the water tests was extinguished with ammonium chloride for DI or peeled off utilizing unadulterated helium after examples (SR-NOM, CRW, and ORW) and gathered after a 3 to 5 min contact time.

Broken down ozone stock arrangement was made by dissolving a high centralization of vaporous ozone into chilled deionized water. Vaporous ozone was produced by OREC™ (Model V5-0, Phoenix, AZ, USA) ozone generator from unadulterated oxygen. Broken down ozone fixations were estimated spectrophotometrically (258 nm;  $\epsilon$ : 3150 m<sup>1</sup>s<sup>-1</sup>) after a 2:1 weakening with a couple of drops of 1.0 N phosphoric corrosive. The stock ozone arrangement of around 40 mg/L was created regularly following 60 minutes. The ozone stock arrangement was straightforwardly added into the water tests in containers.

### CONCLUSION

Water treatment of these dams are profoundly needed as water from these dams are provided for family utilizes and, in any event, for drinking which whenever defiled will cause serious medical problems and even numerous passing are accounted for as a result of drinking tainted water. We have talked about three techniques for water treatment i.e., alum, membrane filtration, activated carbon filters. The utilization of recovered wastewater will give adequate adaptability to permit a water office to fulfill momentary necessities just as to build water supply unwavering quality. With an expanding accentuation on the arranging and usage of wastewater recovery and reuse offices, exact cost information is fundamental. Hence, cost data was

introduced, despite the fact that there are huge varieties in wastewater recovery and reuse costs. In spite of the fact that dry spells regularly underscore the requirement for wastewater recovery and reuse, wastewater reuse is in no way, shape or form a water asset the executives elective for dry season years as it were. It ought to be viewed as an indispensable and perpetual piece of water assets arranging later on.

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