# TREATMENT OF INDUSTRIAL EFFLUENT USING ADDITIVE STRYCHNOS POTATORUM

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**ABSTRACT**

*Strychnos Potatorum is a promising bio-flocculant found in India and the seeds of this plant are popularly used to purify water for drinking in rural and tribal areas. It has the ability to precipitate fine particles into larger masses and make them settle at the bottom by gravity leaving purified water. The seeds contain polysaccharide that causes coagulation and flocculation of contaminants in water. It is also said to be capable of removing heavy metals and other toxic heavy metals from effluent water. The present study evaluates the amount of seed powder to add the effluent water and analyze the quality of clarified water in this following standard jar testing procedures using a range of concentrations 0.5-1.0 grams of powder per varying samples of water range from 100-200 ml. Allow for a 1 hour settling time and analyze the water analysis from the test jar which show the best results. Finally samples of treated and untreated water are tested in a laboratory for turbidity parameters and compare the results*

***Keywords:*** *Strychnos Potatorum, industrial effluent Water, additive, flocculation and sedimentation.*

## I. INTRODUCTION

The present study aims at analysis of turbidity parameters of industrial effluent and their reduction in concentrations in low and economical process. Discharging of effluent waste water without treating not only polluting surface water it may also show effect on ground water pollution and soil pollution. So the effluent must be treated in a proper way to meet discharge level requirements. Thus we have opted for Strychnos Potatorum promising bioflocculant whose seeds are plentily available in India which are popular and widely used in rural and tribal areas for the purification of water [3]. It has the ability to precipitate finer particles into larger masses and make them settle at the bottom by gravity leaving the purified water. Significantly the substance found in the seeds of a nut (Strychnos Potatorum) traditionally used by tribals in Andhra Pradesh to clean water is available plenty for large scale use. Proteins present in the bioflocculant enable it to bind with metals such as zinc, copper and nickel and etc. This process involves chemical methods such as coagulation and flocculation. The coagulation/flocculation process is affected by pH, alkalinity, turbidity, temperature, mixing and coagulant chemicals [2]. Basically coagulation is a process of adding coagulant to destabilize a stabilized charged particle. Flocculation is the process of bringing stabilized colloidal particle together to allow them to

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aggregate to a size where they will settle by gravity. Meanwhile it is a mixing technique that promotes agglomeration and makes particles settling down. During flocculation, gentle mixing accelerates the rate particle collision, and the destabilized particles are further aggregated and enmeshed into larger particles. Flocculation is affected by several parameters including mixing speeds mixing intensity and mixing time. The product of the mixing intensity and mixing time is used to describe flocculation processes [2].

## II. MATERIALS AND METHODS

### 2.1. Preparation of stock solutions

Strychnos Potatorum seeds were collected from local market and were dried under hot sun for 24 to 48 hours. Later the dried seeds were crushed and ground to a medium fine powder or paste. Weigh 100 grams Strychnos Potatorum powder and was placed in beaker containing 1 liter of distilled water [9]. Later this stock solution was used for test trails that were conducted to determine optimum dosages of Strychnos Potatorum on water samples of varying turbidities.

### 2.2. Turbidity stock solution

For preliminary work, collect two water samples with different turbidities from your locality and name them as sample 1 and sample 2. Check general water quality parameters by adding and without adding coagulant Strychnos Potatorum and compare the results. Later, industrial effluents from sugar industry, petroleum industry and agro chemical industries are collected. These are considered as turbidity stock solutions and tested for pH, conductivity, hardness and TDS and also for Heavy metals.

### 2.3. Storage of stock solution

In order to study the effects of storage temperature, the stock solutions were divided into two groups and stored at two different temperatures namely; room temperature (280C) and at 40C (refrigerator). The effects of storage duration on Strychnos Potatorum stock solution were investigated for 0, 1, 3 and 5 days.

## III. EXPERIMENTAL PROCEDURE

### 3.1. Apparatus

1. Standard jars: $\frac{1}{2}$ lit.
2. Sample of water effluents: 100, 150, 200, 250ml.
3. Strychnos Potatorum seed powder: 0.25 and 0.5gm.
4. Stirrer: magnetic stirrer.
5. Analysis kit: conductivity meter, pH meter, hardness kit and TDS kit

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### 3.2. Jar tests

The jar test simulates the coagulation process in a batch mode. A series of batch tests are run in which pH, coagulant type and dosage and coagulant aid are varied to get the optimal dosage (lowest residual turbidity). An economic analysis is performed to select these parameters. Jar tests generally are performed using one-liter samples of the water or waste water to be collected and treated. To these samples a range of coagulant dose is added (one sample is usually a blank) immediately after the coagulant is added the samples are "flash mixed" for approximately 30min. the magnetic stirrer is applied to mix. At the end of the flocculation period the stirrers are turned off and the floc is allowed to settle for one half-hour. After this settling period supernatant samples are drawn off from each sample and analyzed for turbidity, alkalinity, conductivity, pH, hardness and TDS etc.[1].

### 3.3. Treatment process of effluent water using the additive Strychnos Potatorum

Grind the harvested seeds into a fine paste. Both mechanical and electrical grinding methods will work. If you use an electrical grinder, make sure that the ground seeds do not become too hot because heat can destroy the polysaccharides. Determine the amount of seeds paste to add the raw water. Follow standard jar testing procedures, using range of concentrations are 25 and 50milligrams of the paste per varying volume of raw water in ml [8]. Allow for a 1-hour settling time and analyze the raw water from the test jar which shows the best results. Note the volume of flocculent in the bottom of the jars and the relative clarity of the treated raw water .submit samples from the best jar and the untreated sample to a certified laboratory for analysis of pH, conductivity, hardness, TDS. Fill the settling tank with a measured amount of water. Add the 25 and 50 milligrams of seed powder to each 100, 150 and 200 ml of water sample to be treated [9]. The amount to add depends on the jar results. Mix the water and powder vigorously for two minutes and then gently for another 10 minutes .Allow the treated water to sit for 1 hour for the settling out of contaminants [9].

### 3.4. Analysis procedure of water sample

Consider the prepared stock solutions from sugar industry, petroleum industry and agro chemical industries check for parameters such as pH, electrical conductivity, hardness, chlorides, TDS. Now add Strychnos Potatorum additive weighing 0.25 grams and 0.5 grams into water samples of different volumes, stir it by using magnetic stirrer and kept for 48 hours [1]. Later check the same parameters and tabulate the results [4].

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## IV. EXPERIMENTAL DATA ANALYSIS:

### 4.1. Analysis of effluent water from various industries

**Table 1: Analysis of effluent water**

| Analysis of effluent water (before treated) | | | | |
|---|---|---|---|---|
| **Raw water sample** | **pH** | **Conductivity, mhos** | **Hardness, ppm** | **TDS, ppm** |
| Petroleum refinery (sour water) | 7.44 | 0.726 | 251 | 2419 |
| Sugar industry (sour water) | 6.32 | 0.9 | 61.6 | 788 |
| Agro fertilizer industry (sour water) | 5.69 | 6.8 | 5805.814 | 2610 |

**Table 2: Analysis of treated water (V=100 ml; W=0.25gm)**

| Analysis of treated water using additive | | | | |
|---|---|---|---|---|
| **Water sample** | **Volume of sample, ml** | **Weight of additive, mg** | **pH** | **Conductivity, mhos** |
| Petroleum refinery (sour water) | 100 | 0.25 | 6.76 | 0.723 |
| Sugar industry (sour water) | 100 | 0.25 | 6.12 | 0.814 |
| Agro fertilizer industry (sour water) | 100 | 0.25 | 5.61 | 6.7 |

**Table 3: Analysis of treated water (V =150 ml; W=0.25gm)**

| Analysis of treated water using additive | | | | |
|---|---|---|---|---|
| **Water sample** | **Volume of sample, ml** | **Weight of additive, mg** | **pH** | **Conductivity, mhos** |
| Petroleum refinery (sour water) | 150 | 0.25 | 6.8 | 0.723 |
| Sugar industry (sour water) | 150 | 0.25 | 6.2 | 0.83 |
| Agro fertilizer industry (sour water) | 150 | 0.25 | 5.64 | 6.73 |

**Table 4: Analysis of treated water (V=200 ml; W=0.25gm)**

| Analysis of treated water using additive | | | | | | |
|---|---|---|---|---|---|---|
| **Water sample** | **Volume of sample, ml** | **Weight of additive, mg** | **pH** | **Conductivity, mhos** | **Hardness, ppm** | **TDS, ppm** |
| Petroleum refinery (sour water) | 200 | 0.25 | 6.89 | 0.726 | 249.7 | 2118 |
| Sugar industry (sour water) | 200 | 0.25 | 6.29 | 0.832 | 61 | 309 |
| Agro fertilizer industry (sour water) | 200 | 0.25 | 5.66 | 6.78 | 5776.785 | 2223 |

**Table 5: Analysis of sour water (before and after treatment) (V=100 ml; W=0.25gm)**

| **Sour** | **Analysis of sour water (before and after treatment) (V=100 ml; W=0.25gm)** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Raw water sample** | **pH before treat** | **pH after treat** | **Conductivity, mhos before treat** | **Conductivity, mhos after treat** | **Hardness, ppm before treat** | **Hardness, ppm after treat** | **TDS, ppm before treat** | **TDS, ppm after treat** |
| Petroleum refinery (sour water) | 7.44 | 6.89 | 0.726 | 0.726 | 251 | 249.7 | 2419 | 2118 |
| Sugar industry (sour water) | 6.32 | 6.29 | 0.9 | 0.832 | 61.6 | 61 | 788 | 309 |
| Agro fertilizer industry (sour water) | 5.69 | 5.66 | 6.8 | 6.78 | 5805.814 | 5776.78 | 2610 | 2223 |

**Table 6: Analysis of sour water (before and after treatment) (V=100 ml; W=0.5gm)**

| **Sour** | **Analysis of sour water (before and after treatment) (V=100 ml; W=0.5gm)** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Raw water sample** | **pH before treat** | **pH after treat** | **Conductivity, mhos before treat** | **Conductivity, mhos after treat** | **Hardness, ppm before treat** | **Hardness, ppm after treat** | **TDS, ppm before treat** | **TDS, ppm after treat** |
| Petroleum refinery (sour water) | 7.44 | 6.7 | 0.726 | 0.72 | 251 | 248.5 | 2419 | 1689 |
| Sugar industry (sour water) | 6.32 | 6.08 | 0.9 | 0.81 | 61.6 | 60.2 | 788 | 293 |
| Agro fertilizer industry (sour water) | 5.69 | 5.56 | 6.8 | 6.54 | 5805.814 | 5760.9 | 2610 | 2134 |

## V. RESULTS/OBSERVATIONS

The main objective of the study is to determine the specifications of dischargeable effluent water from the various industries. This study is for three different areas of effluent sample such as petroleum refining, sugar industry and agro-fertilizer industry. To know the individual effects of parameters of the study namely pH,

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hardness, conductivity and TDS of treated water sample, further contemplation is to determine the concentrations of heavy metals by varying weight of additives.

### 5.1. Effect of volume, source of sample and additive weight on pH:

The effect of pH is studied for three different volume s of sample by taking 0.25 grams of constant additive. A graph is drawn pH versus volume for three different samples and shown as figure graph 1. Volume of samples and additive weight are maintained at range of 100 to 200 ml and 0.25gms respectively. After settling the flocculent it was found that pH increased to get neutralize (=7) with increasing volume sample [6]. And observed that pH decreased from sour water sample of PR to SI with considering same volume of water sample, it was observed that higher pH for sour water sample of PR.

A graph is drawn pH versus weight of additive at constant volume of water sample for different water samples and shown as figure 2. It was found that pH decreased with increasing weight of the additive at constant volume of water sample.

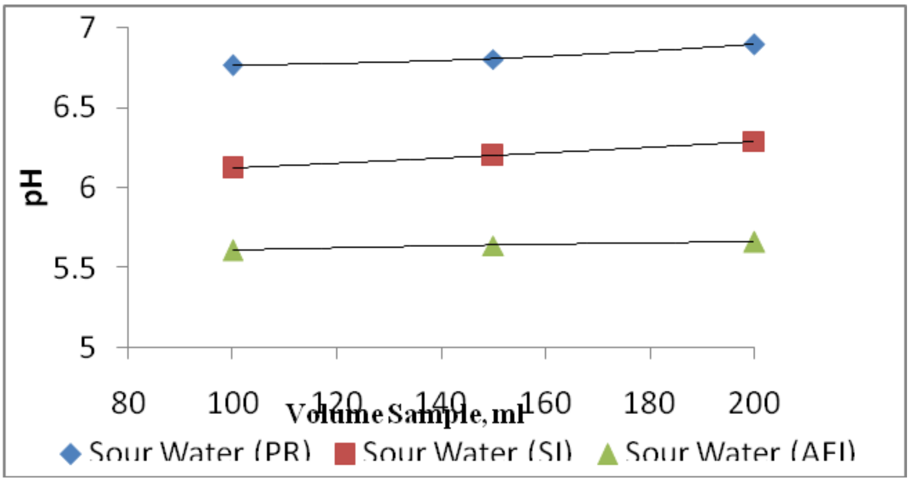


**Fig 1: volume of sample Vs pH at constant additive**

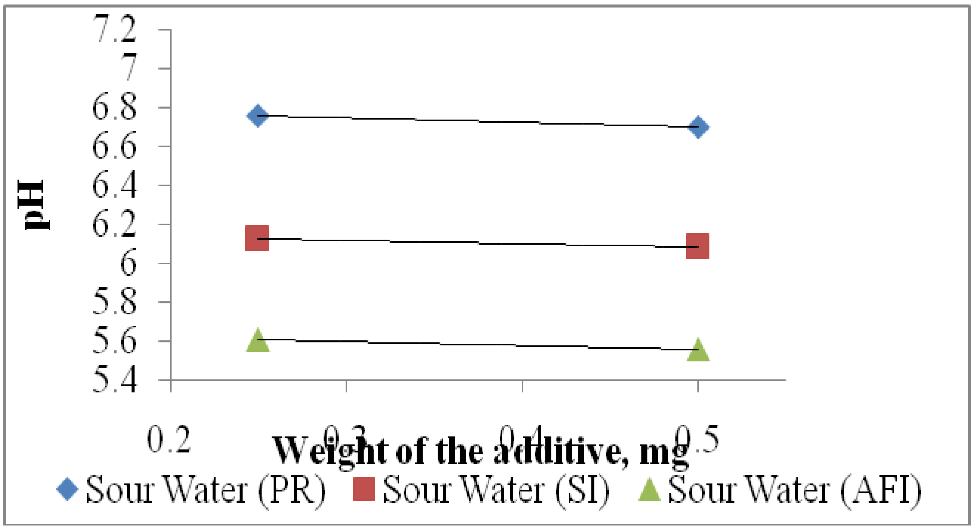

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**Fig 2: Weight of the additive Vs pH at constant volume**

**5.2. Effect of volume, source of sample and additive weight on conductivity**

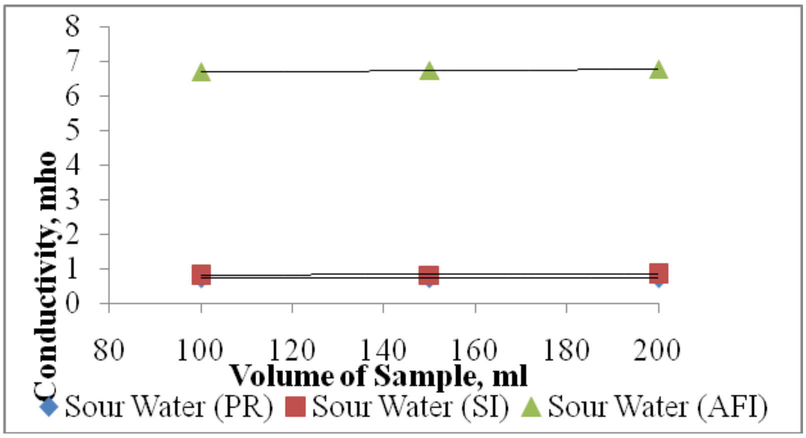


**Fig 3: Volume of sample Vs conductivity at constant additive**

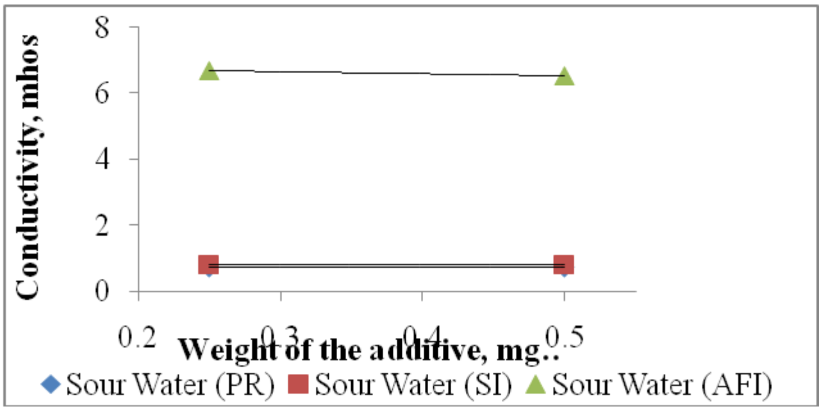


**Fig 4: Weight of the additive Vs conductivity at constant volume**

The effect of conductivity is studied for three different samples by taking 0.25gms of constant additive. A graph is drawn conductivity versus volume for different water samples and shown in figure 3. Volume of samples and additive weight are maintained at range of 100 to 200ml and 0.25gms respectively [5][7]. Further experimentation is done at one hour for settling the flocculent it was found that the conductivity slightly increased with increasing volume of water sample. And observed that the conductivity decreased from sour water sample of PR to SI with considering same volume of water sample. It was observed that higher conductivity for sour water sample of SI.

A graph is drawn conductivity verses weight of additive at constant volume of water sample for different water samples and shown in fig 4. It was found that the conductivity slightly decreased with increasing weight.

### 5.3. Effect of source of sample and additive weight on Hardness

The effect of hardness is studied for three different samples by taking 0.25gms of constant additive. A graph is drawn hardness versus volume for different water samples and shown in figure 5. Volume of samples and additive weight are maintained at range of 100 to 200 ml and 0.25gms respectively. Further experimentation is done at one hour for settling the flocculent it was found that the conductivity slightly decreased with increasing weight of the additive in water sample.

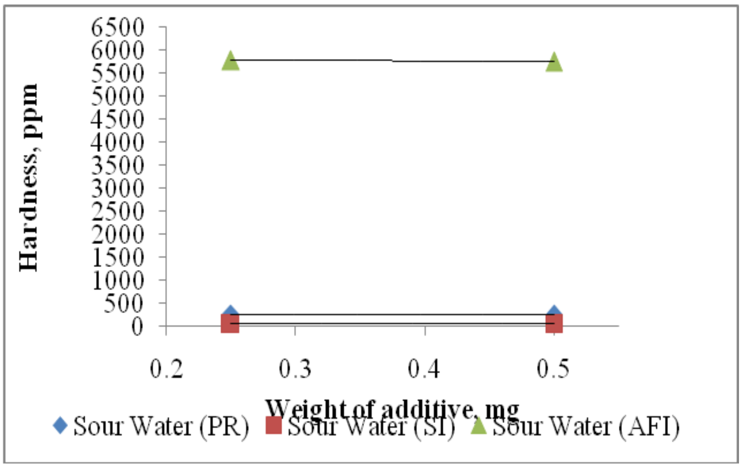


**Fig 5: Weight of the additive Vs Hardness at constant volume**

### 5.4. Effect of source of sample and additive weight on TDS

The effect of TDS is studied for three different water samples by taking 0.25gms and 0.5gms of constant volume. A graph is drawn TDS versus weight of the additive for different water samples and shown as figure graph 6. Volume of samples and additive weight are maintained at range of 100 to 200 ml and 0.25gms respectively. The figure reveals that 15 minutes stirred is sufficient for obtaining the maximum settling. Further experimentation is done at 1 hour for settling the flocculent. It was found that the TDS slightly decreased with increasing weight of additive in water sample at constant volume.

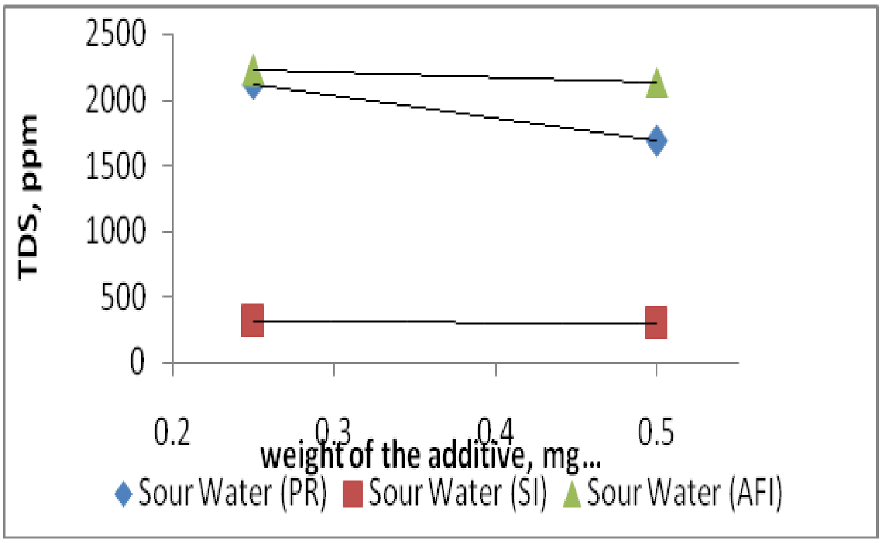


**Figure 6: Weight of the additive Vs TDS at constant volume**

## 6. CONCLUSION

The main objective of the study is to determine the specifications of dischargeable effluent water from the various industries. The individual effects of parameters of the study namely $P^H$, Conductivity, Hardness and TDS studied .Further contemplation is to determine clarified water generated. And the water sample analysis is performed for different parameters by varying water sample at constant weight of additive and varying weight of the additive at varying water sample, with 15 minutes stirring and 1 hour settling time of the sample. This study is for three different areas of effluent samples such as petroleum refining, sugar industry and agro-fertilizer industries. Possibility to remove heavy metals. Eliminate hydrocarbons from effluent. It neutralize PH. It reduce other parameters in the effluent water like TSS, TDS, Conductivity, other minerals, ions , components and compounds etc. Also applicable for flooded areas, mining areas and drinking water scarce areas. Possibility to implement the present work from batch to continuous process.

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