

# Fruit Seeds as Potential Coagulants in Water Purgation

Finu John<sup>1</sup>, Elizabeth Shajan<sup>2</sup>, Lekshmi Ajayakumar<sup>3</sup>, Thomas Kurian<sup>4</sup>, Yedukrishna C.V<sup>5</sup>

<sup>1</sup>Assistant Professor, Department of Civil Engineering, Viswajyothi College of Engineering, Muvattupuzha, Kerala, India

<sup>2,3,4&5</sup>Under Graduate Students, Department of Civil Engineering, Viswajyothi College of Engineering, Muvattupuzha, Kerala, India

\*\*\*

**Abstract** - In developing countries like India, apprehensions about water quality and public health have grown up. The wide range in turbidity that polluted water causes is one of the issues with surface water purification. Synthetic inorganic and organic chemicals are frequently used in different treatment systems. Many of the chemicals are also linked to harmful substances for the ecosystem and human health. That's why we are using natural coagulants as a result. As an alternative to alum in this study, natural endemic coagulants such as Papaya seeds, Watermelon seeds, Jackfruit seeds, and Pumpkin seeds were recommended. In the majority of urban and rural populations, it is easily accessible and widely recognised. The coagulant rate and dosage were tested using the powdered material made from fruit seeds. The primary objectives of this investigation were the elimination of turbidity and the impact of coagulation on sample pH. The study used raw water samples with coagulant dosages of 0.2, 0.4, 0.6, 0.8, 1.0, and 1.2 g/l. The efficacy of turbidity reduction from this investigation was 88%. The outcomes demonstrated that papaya seed may be utilised as a natural coagulant for the purification of water.

**Key Words:** Water, Chemicals, Coagulant, Fruit seeds, Turbidity

## 1. INTRODUCTION

Water is used for many different things, including drinking, washing, bathing, cooking, recreation, and a wide range of different commercial uses. Human consumption of water must be pure because it directly affects health. Despite technological advancements in water supply and treatment, many nations still confront a significant problem, absence of access to healthy and clean water [1]. The traditional water purification technique of using aluminium sulphate, ferric chloride and calcium hypochlorite strains the population's already stretched available funds and capitalizations. Creation of treated water is very costly in most developing countries and unapproachable to mainstream of countryside folks [2][3]. Chemical coagulants used in excess can have a negative impact on human health, and aluminium stimulates neurological disorders. Due to their lack of information about how to properly treat water and their inability to pay the high cost of water treatment, people who live in life-threatening poverty in India have been drinking water that is highly turbid and microbiologically contaminated. In rural tropical regions, natural coagulants have been used for

domestic purposes since ancient times. The primary aids of using natural plant-based coagulants are biodegradability, reduced pH creation and cost effectiveness. The coagulants that appear naturally are thought to be safe for human health [3][4]. Natural coagulant is a substitute to synthetic coagulant in water treatment to reduce its consumption. Additionally, using natural coagulants lowers the expense of the purgation process.

## 1.2 Objectives

This investigation's primary goal is to find out how effective Papaya, Watermelon, Jackfruit, and Pumpkin seeds are at causing turbid water to coagulate.

## 2. MATERIALS AND METHODS

### 2.1 Collection of Water Sample

Kerala's Thodupuzha River served as the source of the aseptically collected water sample for the research. Three different locations were chosen-Kavana, Kadalikkad, Thodupuzha.

### 2.2 Gathering of Seeds

Seeds used in this study i.e. Jackfruit, Watermelon, Pumpkin, Papaya were collected from fruits brought from market and nearby locations.

### 2.3 Making of Seed Powder

Using knife, the fruits were cut open. Water was used to completely wash the seeds. The seeds were then crushed after being sun-dried for seven days. Using a home blender, the seeds were ground into powder. After that, a 600-micronsieve was used to separate the seed powder, and smaller particles were collected in an airtight bottle that was sterile.

### 2.4 The Initial Characteristics of raw water

The water sample's first characterization was carried out to ascertain the sample's fundamental properties like, pH, conductivity, BOD, turbidity, hardness, total dissolved solids, alkalinity and dissolved oxygen. Table 1,2 and 3 lists the characteristics of the raw water sample that was utilised in

this investigation. From table 3, it is clear that turbidity of water sample taken from Kavana was substantially higher as compared to drinking water norms. The necessity for therapy follows. However all other components are within the limits and safe without therapy. To calculate the water's starting and final turbidities, a nephelometer was used. After bio-coagulation, the material was once again characterised. The concluding attributes, including pH and turbidity were identified. Among these four, the most effective bio-coagulant was found.

**Table - 1:** Characteristics of Thodupuzha river water

PARAMETER	INITIAL RESULT	IS STANDARDS
pH	6.88	6.5-8.5
Conductivity	41.69	<400
Turbidity(NTU)	5	<5
Alkalinity(mg/l)	32	<500
Total Dissolved Solids(mg/l)	17.36	<200
Dissolved Oxygen(mg/l)	6	4-6
BOD(mg/l)	0.5	<2
Hardness(mg/l)	24	<200

**Table - 2:** Characteristics of Kadalikkad river water

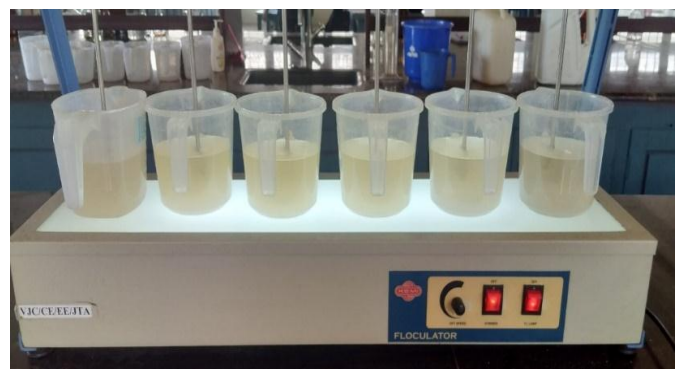
PARAMETER	INITIAL RESULT	IS STANDARDS
pH	6.61	6.5-8.5
Conductivity	38.86	<400
Turbidity(NTU)	4	<5
Alkalinity(mg/l)	32	<500
Total Dissolved Solids(mg/l)	16.63	<200
Dissolved Oxygen(mg/l)	6	4-6
BOD(mg/l)	0.5	<2
Hardness(mg/l)	30	<200

**Table - 3:** Characteristics of Kavana river water

PARAMETER	INITIAL RESULT	IS STANDARDS
pH	6.74	6.5-8.5
Conductivity	43.19	<400
Turbidity(NTU)	25	<5
Alkalinity(mg/l)	34	<500
Total Dissolved Solids(mg/l)	168.36	<200
Dissolved Oxygen(mg/l)	4.5	4-6
BOD(mg/l)	1.2	<2
Hardness(mg/l)	50	<200

### 2.5 Jar Test Apparatus

Jar test analysis was aimed to find out the turbidity removal efficiency of coagulant. Six water samples were given varying coagulant quantities at intervals of 0.2g/l. In a batch procedure, the study included processes including fast mixing, slow mixing, and sedimentation. The next 20 minutes were spent doing moderate mixing at 30 rpm after a 2 minute quick mixing interval at 100 rpm. A 30-minute sedimentation interval was given for the sample. The supernatant was taken after sedimentation in order to calculate the ultimate turbidity.



**Fig-1:** Jar Test Apparatus

### 3. RESULT AND DISCUSSIONS

#### 3.1 Pumpkin seed powder

**Table -4:** Changes in turbidity and pH using various amounts of Pumpkin seed powder

SLNO	DOSAGE(g/l)	TURBIDITY(NTU)	pH
1	0.2	11	6.9
2	0.4	8	7
3	0.6	5	6.92
4	0.8	9	6.98
5	1	13	7
6	1.2	17.5	7.12

The optimum dose was determined to be 0.6 g/l with a turbidity value of 5 NTU. The percentage turbidity reduction effectiveness of Pumpkin seeds was 80%.

#### 3.2 Papaya seed powder

**Table -5:** Changes in turbidity and pH using various amounts of Papaya seed powder

SLNO	DOSAGE(g/l)	TURBIDITY(NTU)	pH
1	0.2	12	7.4
2	0.4	9	7.45
3	0.6	6.4	7.5
4	0.8	3	7.3
5	1	7	7.38
6	1.2	11	7.32

The optimum dose was determined to be 0.8 g/l with a turbidity value of 3 NTU. The percentage turbidity reduction effectiveness of Pumpkin seeds was 88%.

#### 3.3 Watermelon seed powder

**Table -6:** Changes in turbidity and pH using various amounts of Watermelon seed powder

SLNO	DOSAGE(g/l)	TURBIDITY(NTU)	pH
1	0.2	9.2	7.3
2	0.4	7.6	7.23
3	0.6	3.8	7.19
4	0.8	7.4	7.32
5	1	10	7.29
6	1.2	12	7.2

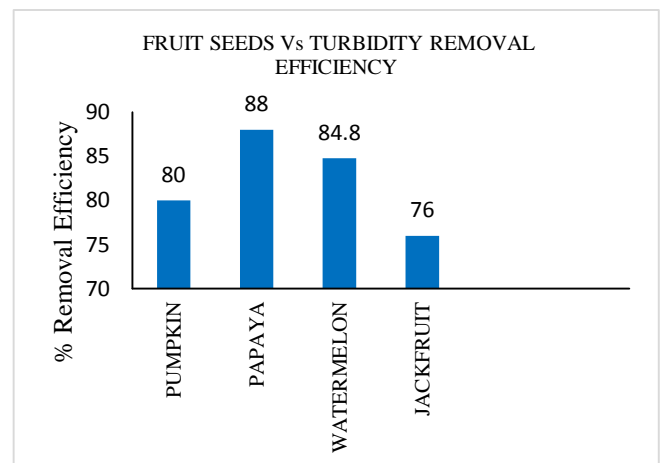
The optimum dose was determined to be 0.6 g/l with a turbidity value of 3.8 NTU. The percentage turbidity reduction effectiveness of Pumpkin seeds was 84.8%.

#### 3.4 Jackfruit seed powder

**Table -7:** Changes in turbidity and pH using various amounts of Jackfruit seed powder

SLNO	DOSAGE(g/l)	TURBIDITY(NTU)	pH
1	0.2	13	7.1
2	0.4	10	6.92
3	0.6	6	6.82
4	0.8	8.9	6.98
5	1	11.8	7.02
6	1.2	14.7	7.12

The best dose was determined to be 0.6 g/l with a turbidity value of 6 NTU. The percentage turbidity reduction effectiveness of Pumpkin seeds was 76%.



**Chart -1:** Bar Graph showing turbidity removal efficiency of fruit seeds

Turbidity Removal efficacy of various fruit seeds are compared. The graph shows that Papaya seed powder has the greatest effectiveness for eliminating turbidity.

#### 4. CONCLUSION

In this research, the primary focus was on the effectiveness of bio coagulants like like Papaya seed powder, Watermelon seed powder, Jackfruit seed powder and Pumpkin seed powder in removing turbidity. At the recommended dosage of 0.8 g/l, turbidity was reduced by 88% using Papaya seed powder as coagulant. At an ideal dosage of 0.6 g/l, turbidity removal efficiency of 84.8% was achieved using Watermelon seed powder as coagulant. At the optimum amount of 0.6 g/l, turbidity removal effectiveness using jackfruit powder was 76%. Pumpkin powder was used to achieve an 80% fall in turbidity at the recommended coagulant dosage of 0.6 g/l. With a removal efficiency of 88%, Papaya seed powder is found to have the peak turbidity elimination efficacy when likened to the former bio-coagulants utilized. The findings made also led to the conclusion that the amount of chemical-based coagulants could be decreased when natural coagulants were used as a coagulant, which could benefit to moderate the undesirable properties brought on by chemical-based coagulants.

#### 5. REFERENCES

- [1] Krishnapriya G Nair<sup>1</sup>, Mingul Pertin, Prince Philip Kadavil<sup>1</sup>, Jency Nadayil "Emerging Trends in the Usage of Bio-Coagulants in Waste Water Treatment" International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 04, Apr 2019
- [2] Francis KwekuAmagloh and Amos Benang, "Effectiveness of Moringaolifera seed as coagulant for water purification", African Journal of Agricultural Research, Vol. 4(1), pp.119-123, February 2009.
- [3] Arya Chandran J, Duithy George, "Use of papaya seed as a natural coagulant for water purification", international journal of scientific Engineering and research(IJSER), Volume 6, Issue 3, March 2018.
- [4] Dr. ShwetaVerma, IsmaMehraj, Anshul Jain, Anil Prasad Ray," Application of Zia Mays & Cucorbita Pepo as Natural coagulants for Purification of River Water", International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 5, 693-696 May 2015.
- [5] Nimesha, C. Hewawasam<sup>1</sup>, D.J. Jayasanka, Y. Murakami, N. Araki, N. Maharjan 'Effectiveness of natural coagulants in water and wastewater treatment' Global Journal of Environmental Science and Management Global J. Environ. Sci. Manage. 8(1): 101-116, Winter 2022
- [6] Mahmood N. A. Cand Zaki Z. Z. M 'The Effectiveness of Raw and Dried Artocarpus Heterophyllus (Jackfruit) Seed as Natural Coagulant in Water Treatment' IOP Conf. Series: Materials Science and Engineering 601 (2019)
- [7] Bello, J. A. Aminu, B. B. Abubakar, H. I. Mukhtar 'Assessment of Watermelon Seed (Citrullus Lanatus) as a Potential Coagulant for Water Purification' International Journal of Scientific Research in Chemical Sciences Vol.6, Issue.3, pp.4-7, August (2019)

#### BIOGRAPHIES



**Finu John**  
Assistant professor  
Department of Civil Engineering  
Viswajyothi College of Engineering  
and Technology, Kerala



**Elizabeth Shajan**  
4<sup>th</sup> year student, Civil Engineering  
Viswajyothi College of Engineering  
and Technology, Kerala



**Lekshmi Ajayakumar**  
4<sup>th</sup> year student, Civil Engineering  
Viswajyothi College of Engineering  
and Technology, Kerala



**Thomas Kurian**  
4<sup>th</sup> year student, Civil engineering  
Viswajyothi College of Engineering  
and Technology, Kerala



**Yedukrishna C.V**  
4<sup>th</sup> year student, Civil engineering  
Viswajyothi College of Engineering and  
Technology, Kerala