AN EMERGING FUTURE TREND IN WASTEWATER TREATMENT WITH ITS INNOVATIVE PRODUCT

Abstract

Pollution is a serious world issue that causes varying levels of damage to the environment and life on earth. Recent years have seen a sharp increase in water scarcity, posing a challenge to humanity on a global scale, especially since the available water supplies are further constrained by various forms of pollution. The function of chicken Feather as a supposed adsorbent for eradicating of the dangerous synthetic organic dyes arising out of waste water is discussed in this chapter. It begins by outlining how crucially important clean water is for humanity and how crucial the adsorption technique is for removing dangerous pollutants from water over other physicochemical techniques. In the presence of thiourea, diluted alkaline solutions were used to partially hydrolyse hen feathers. After that, carbon disulfide treatment dithiocarbamylated the hen feathers. Polyvinyl alcohol was used with the product to create environmentally friendly films.Fourier Transform Infrared spectroscopy, powder XRD, scanning electron microscopy, and differential scanning calorimetry had been used to analyse these films. The adsorption technique had analysed by application of various kinetic and isotherm models. Extreme adsorption ability for methylene blue and crystal violet out of possession of aqueous solutions.

Keywords: chicken feather, dithiocarbamylation, methylene blue, crystal violet, dye adsorption.

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I. INTRODUCTION

The most limitless and plentiful resource on Earth, water has seen the most extravagant use by humans. This strange substance is also referred to as "the compound of life" because it has remarkable physical characteristics. It has an average abysm of 3000 meters and covering third quarters of the earth's exterior. In spite of so immensely of an accessible sum, as it were 1% of it is usable to us since 97% is salty seawater and 2% is solidified in ice sheets and polar ice caps. In this way, roughly 1% of the World's water supply could be a valuable product essential for our survival [1–3]. Drinking water that is safe, healthy, and free of disease is a requirement for humanity's survival. It is subsequently not astounding that we have veracious watched the springs of water and over the centuries numerous clatters have taken put over water rights. Specialists have as of now cautioned of the prospect of a water emergency, which may be anticipated given the quick increment in populace. As a result, vigilant then appropriate organization also protection of usual water is indispensable on a global scale. Despite mother nature's amazing capability to reduce eco-friendly harm, the rising petition for water still want harnessing human skills to sustain the eminence along with the quantity. To meet all our desires for manufacturing, agronomy, electricity, irrigation, and further purposes necessary for the growth of civilization, we must treat water carefully. Because of nowadays water contamination has become one of the main environmental glitches then the control of water contamination is one of the major worries of the social order. Agriculture and food waste have been the most major economical way of living from decades. But every coin has its two sides likewise an enormous amount of agriculture and food waste are produced per annum. Some amount used in useful stuffs like for cattle feed but most of it thrown away or disposal producer that may cause crucial environmental pollution and harmful effect on human as well as animal health. Whatever that remains no longer usable also desires to be rid of is considered left-over. Additionally, garbage can remain categorized based on the kind of production it is and the location, such as agricultural, domestic, industrial, and mining. Large amounts of wastewater and solid waste are produced by the chicken business. The strong squander is made up of bedding fabric, excreta (fertilizer), bolster, plumes, shells, slime, abattoir squander (offal, blood quills, and fated cadavers), and transience. Incubation centre squander incorporates purge shells, barren eggs, dead embryos, and late hatchlings. Plant materials, which mostly comprise of ruffage components that may absorb heavyweight metallic cations in aqueous solution, are also made up of food waste and agricultural waste. Nature provides a variety of waste biomass sources whose adsorption capabilities have been described, including sawdust, rice rind, tea and coffee grounds, orange shell, peanut grenades, activated carbon, dry tree shrubberies, and bark [4].

II. EASE OF USE

1. Different ways obtain of waste from different type of industries

Figure 1: Types of Waste from Different Industries

Now Pollution is a serious world issue that causes varying levels of damage to the environment and life on earth. The carelessness of human actions is the real source of water contamination. It is convenient for many of us to dump rubbish into a brook or pond for discarding. The squander arranged of in expansive or little sums, dumped intentioned or incidentally, is carried absent by the water current, but will never vanish It'll return downstream, now and then in a diverse shape, now and then fair weakened. [5-7]. Various physical methods for treatment, like as nanofiltration, diffusion, ion exchange, air stripping, and the rest, have also been used, and it has been discovered that these merely transference contaminants to additional stage rather than eliminating them. Some of the strategies outlined above have been shown to be quite effective, despite several flaws. The basic drawback of the advances talked about over is that they for the most part need the wide extend of treatment productivity required to evacuate all sorts of contaminants found in material wastewater. Be that as it may, when one approach does see promising, its capital costs or working costs frequently gotten to be restrictive when connected to the expansive water desires communal to at all industry. The need to treat wastewater in a way that is both affordable and environmentally sound has grown to be a serious issue. As a result, the adsorption procedure take confirmed to remain extremely effective method used for removing hazardous contaminants in the area of aquatic treatment. Adsorption is a technology that is quickly gaining popularity for treating textile effluents after wastewater treatment. Adsorption has been confirmed to be further advantageous used for reducing water pollution because it involves fewer initial expenditure then land-living. Second, the therapy apparatus is straightforwardly constructed and simple to use. There has been a extraordinary

bargain of intrigued in embracing low-cost adsorbents for wastewater decolorization to lower working costs. These substances consist of chitosan, zeolite, fly ash, coal, oxides, agrarian wastes, wastes from legionellosis, etc. Animal waste materials like hairs, bones, etc. have been used as adsorbent in very little published work thus far.In specifically for the elimination of colours from wastewater using by Chicken Feathers as a possible adsorbent and reached extraordinarily good results. [8-17] Innovative ways to develop another energy sources and resources include certainly presented substitutes such as food and poultry waste [18**].** poultry wastes have been employed for a few decades in a variety of fields, including nanotechnology, to create new, essential composites. Almost half of all known compounds have been shown to be dissolved in natural water, and even a sparkling clear stream of water can contain complex mixtures of organic and inorganic elements [19] It increases downstream, sometimes in different forms, sometimes simply. Diluted Mother Nature has a excessive capability to breakdown leftover ingredients, but not in the quantities castoff by today's culture. The excess that results, called contamination, ultimately puts the environment out of balance. Most of the time, community, agrarian, and manufacturing wastes contaminate our rivers, plus numerous dangerous artificial compounds that cannot be wrecked downcast by normal processes. Known as birds, warm-blooded vertebrates are distinguished by feathers, toothless beaks, hard-shelled eggs, fast metabolism, four-chambered hearts and strong but light skeletons. [20] Poultry waste may be useful in a variety of ways. Composite celluloses, proteins, fats, carbon-based acids, enzymes, and nutraceuticals make up food left-over [21] Although there has been much discussion on the definition of poultry waste for the purposes of this analysis, it is defined as any eatable or uneatable food that is vanished from the food source chain. The amassing of food wastelands poses ecological and economic problems. Food waste subsidizes more than 10-20% of the world's total releases of greenhouse gases (GHG), such as carbon dioxide (CO2), nitrous oxide (N2O), and methane (CH4). Food waste also harms the ecosystem by reducing land use and polluting groundwater near landfills. [22] Disposal of raw poultry compost without further processing is harmful, unsafe and causes serious environmental problems such as unpleasant odour, leaching of toxic elements such as heavy metals, methane emissions, eutrophication of water bodies, nutrient imbalance, phytotoxicity and spread of pathogens and weeds. The usual daily production of fresh compost per broiler is about 43 kg per 1000 kilograms of live weight. Poultry clutter production on a dry weight basis ranges from 0.8 to 2.1 tons per 1,000 broilers per flock. [23]

- **Structure of Feather:** Parts of feather –i) Rachis– the rachis is the stiff central shaft and Barbs constitute the softer portion of the feather. ii) The barbs are interconnected by hooked barbules called hamuli,iii)Calamus is the part of the shaft held in the feather follicle on the skin of the bird.[24]

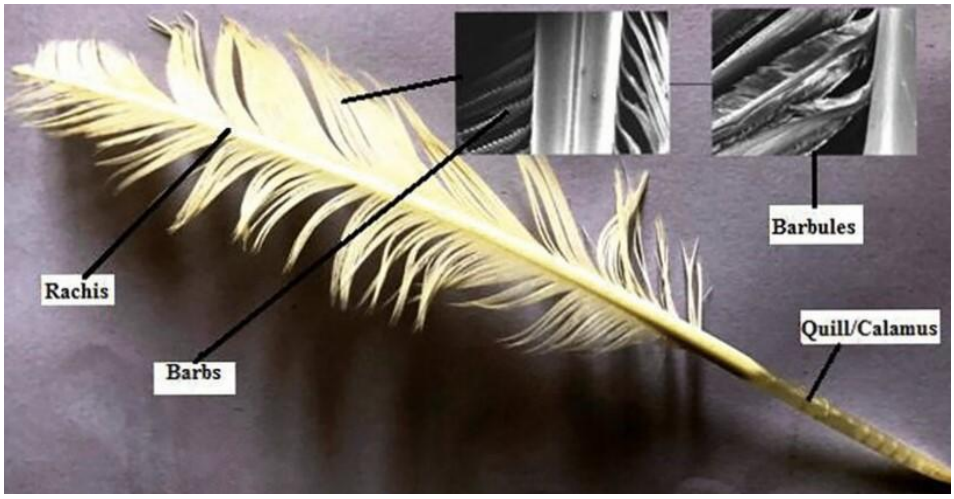

Figure 2: Structure of feather

2. How Birds Use Their Feathers

As indicated by the different feather types described below Table

Table 1: Different types of Feather and their uses

Feather type	Description	Barbule	Function
Flight	long, stiff, asymmetrical	Hooked	flying
Contour	colorful, part still, part fluffy	Hooked and smooth	Protection
Down	soft, fluffy, small in size	smooth	Insulation
Semiplume	cross between contour and down feather	smooth	Insulation
Filoplume	Very small, sparse barbs at tip	Smooth	sensory
Bristle	short and stiff	smooth	Sensory

Avian feathers have a keratin content of about 90%. The global annual feat of offal production is around $8 * 10^5$ tonnes. Processing feather waste to soluble keratin, which might be used to create innovative bioproducts, is an alternative technique of utilizing feather waste. [25]

III. POULTRY SUB SECTOR REQUIREMENT

Need Environment for policy development? Support and interventions are needed primarily for diseases surveillance, drug residues and quality control of drugs/vaccines, standardisation and quality control of feed ,poultry eggs and meat, apply HACCP(Hazard Analysis and Critical Control Points)and upright industrial observes to comply with WTO and CODEX standards and grading, value in addition, promote the brand and promote exports(approximately about Rs 532 crores in 2016-17)etc. (26)given below Table no. 2

Table 2: Requirement of Poultry Sub sector

BOOST TO INTERPRETENSHIP DEVELOPMENT AND EMPLOYMENT GENERATION PROGRAM	•little/borderline •impressario-must bother scheme and economic intercession.
Apprehension and grip in weal, food safty, public health ecology , export scheme	•Commercial poultry need for policy interruption
Convey invention improve biosecurity and grip to upgrade and follow clump	•Backyard poultry need fiscal intervention

1. Ways of Industrial Wastewater

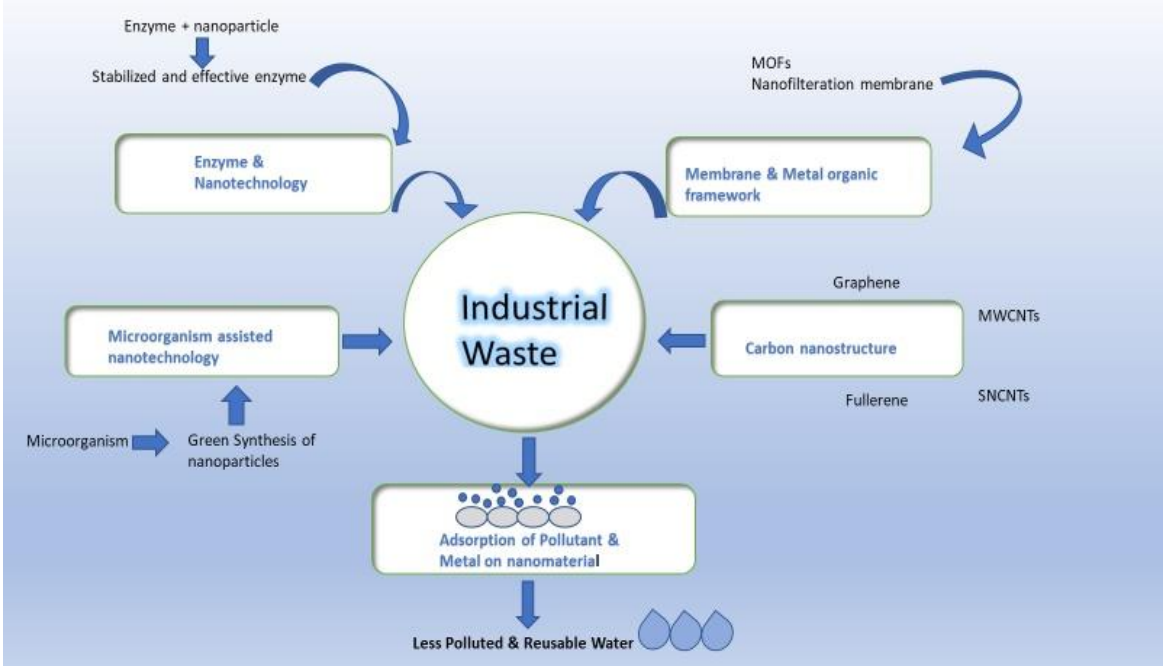

Figure 3: Multi-stream Industrial Waste Water

IV. MATERIAL AND METHOD

1. Material

- **Adsorbate Material**

  - **Methylene Blue:** Is a vibrant organic salt molecule, is used as an adsorbate material. Swiss blue and methylthioninium chloride are other names for it. The most frequently used dye in the material manufacturing for finishing purposes is methylene blue (MB). This dye remains a highly oncogenic phenothiazine imitative that promotes hypertrophication and accordingly degrades marine media and wild life life circumstances. Skin aversions, nausea, nervous system sicknesses, cardiac injury, breathing difficulties, sickness, and gastrointestinal infection can all be caused by MB [27-29]. To evade the detrimental possessions of this dye on community fitness, MB must be removed from aqueous samples. [30]. A variability of methods for eradicating MB from bodies of water have been recognized. Photo-oxidation, organic decrease [31-33], adsorption [34], biotic treatment [35], film flotation [36], flocculation [37], and photocatalytic degradation [38,] are among the approaches documented.

Table 3: Details of Methylene Blue

Chemical Formula	$C_{16}H_{18}N_3SCI$
IUPAC NAME	7−(dimethylamino)phenothiazin−3−ylidene - methyl azanium; chloride
Colour in Acid	Blue Colour
Colour in Base	Colour less
Molecular Weight	319.85 g/mol.
Physical State	Solid, Dark Green Powder at room temperature
Order	Orderless
Melting Point	100-110 ^{0}C
Soluble/Insoluble	Soluble in Water/ Insoluble in Chloroform
Maximum Absorption	665-670 nm
Specific Gravity	~1.00 g/mL @20^{0}C

Methylene blue is represented by the formula $C_{16}H_{18}N_3SCI$
It has 3,7-bis (dimethyl amino) phenothiazine - 5 – ium chloride as the counterion.
Its IUPAC name is 7−(dimethyl amino) phenothiazin−3−ylidene
7−(dimethyl amino) phenothiazin−3−ylidene - methyl azanium; chloride.

  - **Crystal Violet:** Also known as gentian violet, methyl violet 10B or hexamethylpararosaniline chloride. Crystal violet is used as an adsorbate material in our work Gentian Violet is a main dye utilize in the process of Gram stain. It is a triarylmethane dye that remains also referred to as CV. Although the name CV

was originally intended to describe a mixture of methyl pararosaniline dyes (methyl violet), nowadays usually used interchangeably with Crystal Violet. It is not made from gentians or else violets, and its name mentions to the colour of its petals, which look like those of some gentian flowers. GV is an basic dye derived from carbon-based chloride salts of the triphenylmethane family. It has numerous biological and commercial applications, including fingerprinting, toner tinting, antifungal, antiseptic, anthelmintic agents, and histological discoloration. Gentian Violet is similarly identified as Basic Violet 3, Crystal Violet, Hexamethyipararosaline chloride, and Methyl Violet 10B. It is a dark green complex with a metal luster once powdered, but when melted in a solvent, it goes voilet. The dye's distinct hues are caused by the different charged states. crystal Violet is an aniline-derived dye with the chemical formula of $C_{25}N_3H_{30}Cl$

Table 4: Details of Crystal Violet

Chemical Formula	$C_{25}H_{30}CLN_3$
IUPAC NAME	3−(dimethylamino) Phenylmethyldimethylazanium
Colour in Acid	Yellowish- Green (Due to low pH)
Colour in Base	Bluish-Purple (Due to High pH)
Molecular Weight	407.9 g/mol
Physical State	Solid
Order	Orderless
Melting Point	205^0 C
Soluble/Insoluble	Soluble in Water,Alcohol &Chloroform/ Insoluble in Ether & Xylene
Maximum Absorption	592 nm
Specific Gravity	/mL @20^0 C

- **Adsorbent Material**

  - **Hen Feather:** Feather have beautiful and skilled structures. Figure 2 details the feather's component elements. According to a review of the literature, the usage of chicken feathers as a applicant aimed at a probable adsorbent for the elimination of harmful dyes remained a novel idea that was initially developed in a lab [8-17]. Prior to 2006, Al-Asheh and colleagues [39-41] were the leading researchers in the field of using chicken feathers as an adsorbent individual for the elimination of metal ions. Similar research was done [42] employing group adsorption techniques and chicken feathers as an adsorbent to remove dual arrangements of copper, zinc, and nickel ions. Teixeira et al. [43]. Established a biotic approach aimed at through sorption of aqueous As (III) species over unused biomass derived from chicken feathers with a high fibrous protein content. Attempts have been undertaken in recent years to use chemically modified feathers to remove heavy metals (Zn2+) from polluted water [44].

- **Production of Adsorbent Material:** As mentioned previously, chicken feathers typically have a lenient hook portion also a firm rachis. The poultry feathers remained roughly one centimetre long and filthy. The feathers were initial stirred in a wash of distilled water to remove filth, blood stains, and odour, and then they were repeatedly cleaned in particularly purified water. The cleaned feathers remained before dried out, their lenient hooks remained sliced into tiny parts with a sharp knife that were each about 0.1 mm long, and the central rachis were removed and thrown away. The resulting barbs were then exposed to 30% v/v hydrogen peroxide for around 24 periods to oxidize the carbon-based material adhering to the barbs. The substantial was then placed in an oven set at 100 C for 12 hours to remove the moisture, and the resulting activated adsorbent was held there in a vacuum desiccator until it was needed.

2. **Methodology:** Simple and affordable alkaline hydrolysis is used to hydrolyse HF. and after that, thiourea is used with NaOH as a reducing agent. Using CS2, partially hydrolysed HF is dithiocarbamylated. Different ratios of PVA, glycerol, glutaraldehyde, and HCl are mixed with DTCCF. PVA is used to aid in the development of films since it has a favourable tendency to do so.In addition to glutaraldehyde and HCl, glycerol also serves as a plasticizer and a cross-linker. The film was pigeonholed by scanning electron microscopy, Fourier transform infrared spectroscopy, X-ray diffraction analysis, differential scanning calorimetry and atomic force microscopy. This film remained used as an efficient adsorbent to eliminate methylene blue and crystal violet from their aqueous solutions.

V. COMPARATIVE STUDIES OF LOW-COST ADSORBENT

Table 5: Description and Application of Low-Cost Adsorbent

Adsorbent (Low cost)	Descriptive	Application	Ref
Ostrich Feather	Isotherm Adsorption	Removal of Phenol from aqueous solution	44
Chicken Feather	Statically Physics Analysis	Physical Interpretation of the adsorption mechanism of heavy metals of ions (Pb^{+2},Ct^{+2},Ni^{+2})	45
Lignocellulosic base bio sorbent	Sustainable framework by emerging pollutant.	Adsorption of pharmaceutical and heavy metal pollutant in waste water.	46
Corn Stalk and Premna microphyll leaves	Bio aerogel	Oily water treatment	47
Azadirachta Indica (Neem Saw Dust)	Adsorptive elimination of cationic dyes	Removal of crystal violet from aqueous solution	48
Trypolyphosphate (TPP)	Chitosan based magnetic adsorbent and vanillin CMN	Synthesis surface modification characterization and application $Cd^{+}2$,$Co^{+}2$,$Cu^{+}2$,Pb^{+2} ions removal from waste water.	49

Cinnamon Barc Biomass	Green Strategy	Removal of cationic methylene blue dye from waste water	50
Pigeon Feather	Kinetic and isotherm study	Kinetic and Isotherm studies of Congo red dye from aqueous solution.	51
Sugarcane bagasse	Kinetic and equilibrium isotherm	Removal of different petroleum hydrocarbon water pollutant	52
Rice Husk	Green Synthesis	Mitigating Waterborne Contaminant	53

VI. CONCLUSION

The key aspects of this research were to progress a profitable, swift and versatile way for taking away the risky dyes (methylene blue and crystal violet) from wastewater and to apply waste material Chicken Feather as prospective adsorbent. The research displayed in this chapter certainly establishes that all Hen Feather can be strongly engaged as adsorbent to take away the venomous dyes from wastewaters. The accessibility of waste material is ample and discarding this always been a challenge, the implementation of such a honest cause as expected to thrive efforts for the well-being of society. Outcome displayed in this chapter clearly recommends that the comprehensive research have been made right through the progression of the dye eradication process. So, to conclude that Chicken Feather react as an successful and environmentally safe adsorbent for the removal of risky organic pollutants–dyes from wastewater and the adsorption process emerges during the course of present investigations are effective, environmentally safe and profitable.

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