Quest Journals
Journal of Research in Environmental and Earth Sciences
Volume 12 ~ Issue 2 (February 2026) pp: 66-67
ISSN(Online) :2348-2532
www.questjournals.org

Research Paper

Development of Bio-Composites from Tannery Solid Waste and its application in Waste Water Treatment.

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Received 12 Feb., 2026; Revised 20 Feb., 2026; Accepted 23 Feb., 2026 © The author(s) 2026.
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I. Introduction:

The tanning industry is one of the oldest and fastest growing industries in South and South-East Asia and this part of the world dominating the annual global leather production. There are more than 3000 tanneries mainly located in four state of India (West Bengal, Uttar Pradesh, Punjab and Tamilnadu) with a total

processing capacity of 7 x 10^5 tons of hide and skins per year. A major portion of these generate huge amount of solid waste as chrome shavings and chrome containing buffing dust since most of the tanning process involves chromium. If these are not properly utilized/recycled, it will bring serious environmental threat to the society and being a leader in global leather producing segment, this part of the world will suffer utmost pollution hazards.

Water pollution is a serious problem in India as almost 70% of its surface water resource and a growing percentage of its ground water are contaminated by biological, toxic, organic and inorganic pollutant. The rapid industrial expansion, inappropriate use of fresh water, discharge of wastewater without proper treatment, lack of awareness and negligence in proper monitoring & implementation of environmental related regulations are responsible for such pathetic water quality situation. In compare to other water purification and recycling techniques (Precipitation, Ion-exchange, Reverse osmosis, Photocatalytic treatment, Electro dialysis, Cementation etc.) adsorption is the fast, inexpensive and universally accepted method which worked well even at low concentration of the contaminants. To be an effective adsorbent for the treatment of bulk water treatment system, adsorbent material should not only be efficient, reusable, inexpensive and abundantly available, but also be bio-compatible and bio-degradable. As we have ample sources of solid wastes from leather processing industry (tannery) which have huge potential to act as superior reusable adsorbent material. It can be an efficient, economical and environment friendly alternative resource to treat such toxic water. From practical point of view, at present these solid wastes are considered as the environmental hazards and appearing as a great threat not only for the Indian Leather Industry but also equally for the Global Leather Industry. But, if these solid wastes can be reused as adsorbent for the treatment of toxic water, then after subsequent reuses when these materials will not be in further re-usable condition, it can be dumped harmlessly. Therefore, through this process, not only the toxic water is going to be purified but also these solid wastes will be converted from harmful to harmless condition for dumping. Therefore, to reduce the overall pollution loads, it is doubly beneficial.

A brief overview of literature pertaining to the work:

The solid waste from tanneries is a major concern among tanners and environmentalist. These solid wastes are rich in collagen and often use for the manufacture of glue or gelatin, but those require several steps and use of sophisticated and expensive machineries. Hence, currently most of these materials are dispose doff as landfill. Unfortunately, disposal through landfill will result not only in loss of valuable substances but also leads to reduction of air and water quality. Hence, finding a means and use for these items is the current need. In spite of numbers of innovative approach (Sundar et al. 2011) actual practical application are very less and there is a huge gap between waste generation and waste utilization related to leather industry throughout the world. Due to presence of various active functionalities it has enormous potential to be some efficient adsorbent materials. In fact, few promising applications have already been reported by few authors eg. removal of pollutant from water (Saravanabhavan et al. 2007; Oliveira et al. 2007; Fathima et al.

2009,2012; Carpenter et al. 2013), removal of Cr(VI), As(v) (Fathima et al. 2005; Oliveira et al. 2008)

Research Objectives:

Objective of this research is to develop an efficient adsorbent material from generated solid waste of leather industry for the treatment of toxic wastewater and subsequently to control the industrial pollution at multiple end.

Research Methodologies:

Significant amount of collagenous solid waste is generated in our country by leather processing industry. Unsecure disposal of these items is certainly unsafe and un-healthy for the society. Hence, this must be utilized properly to avoid serious pollution threat. In the present research work our aim is to develop carbon material from shaving dust of leather industry solid waste. Thereafter our aim is to develop useful adsorbent material by tuning its chemico-physical properties by preparing polymeric composites for the treatment of toxic wastewater containing heavy metals, dyes, pesticides. In this process overall waste minimization is optimized by using waste utilization programme with tannery solid waste is unique and highly beneficial for the societal development of our country.

Research Plan:

1. Shaving dust collected from leather industry will be converted into carbon material by oxidative carbonization using muffle furnace.
2. As developed carbon material is non polar in nature which material will be functionalized using various polar materials to improve its efficacy of the material towards the adsorbent of different pollutants
3. Physico-chemical characteristics of the developed carbon-composite will be done using various analytical instruments; e.g. SEM-EDX, FTIR, Solid State NMR, BET Surface area analysis; TGA, DSC, XRD etc.
4. Adsorption efficiency of the developed material will be optimized with different organic and inorganic (e.g. heavy metals dyes, organic pollutants like PCB, PAH, Pesticide etc.) material which generally present in waste water, release by different industries.
5. Physico-Chemical Parameters of adsorption of different pollutant by the developed adsorbent will be optimized to get insight of adsorption properties of the adsorbent material.
6. Efficiency of the adsorbent towards the treatment of industrial will be tested with the developed adsorbent.

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