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Physicochemical Variations of Different Coconut Husk Ponds

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Abstract

The coir industry is one of the major agro-based industries contributing significantly to the national income. This work deals with the characteristics of the waste water discharged from the coir industry in three different regions of Kanyakumari Dist of Tamilnadu. The results presented here are the physical, chemical and microbiological analysis of the waste water samples collected from the coir industry. The analysis indicates the Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and nutrient such as nitrate, nitrite, ammonia and calcium were recorded high amount and a microbial populations including bacteria, fungi and algae in the waste water.

Keywords: coir pith, physico-chemical properties, COD, Ammonia

Introduction

The coir industry is one of the major small scale agro-based industries of the southern states contributing notable employment opportunities to the rustic communities. Coirpith, industry require a large amount of water and consequently generates an equally large quantity of waste water, which contains 27.8% of cellulose, 28.5% of lignin and 8.12% of soluble tannin like phenolic compounds (Vinodhini *et al.,* 2006). The coastal belt of Kanyakumari district, Tamilnadu also having number of coir retting ponds and the coir produced from that area are comparatively good than the other places. The western belt Kollencode, middle Inayam and eastern Rajakamangalam areas are the major coir producing regions of this district. Huge amount of retting ponds were also available in this region with their usual odor.

The effluent generated from the coir industry is acidic, also contains phenolic compounds and other toxic substances. Numerous microbes were also colonized in the retting ponds and support the process in constructive and depressing manner. Traditional, conventional method of retting has adverse impact on the eco system including fauna, flora and human beings. The retting of coconut husk has brought about by the pectinolytic activity of microorganisms especially bacteria and fungi, degrading the fiber binding material of the husk and liberating large number of organic substance into the water. The oxidation of the organic matter liberates hydrogen sulphide which adversely affect the natural eco system which adversely affect the natural eco system lack of dissolved oxygen, very high COD, chloride, hardness ,nutrients and low pH with foul smell of hydrogen sulphide are the characteristic futures of retting yards. Hydrogen sulphide is a major pollutant of the water bodies~ the blackening sediment in the polluted area was due to the local chemical reaction where sulphates get converted to sulphides (Hynes, 1966). Likewise, accumulation of ammonia also a major setback of this area affects the living organisms, making bad odor in this place and severally affects the water quality.

Water quality is the physical, chemical and biological characteristics of water (Diersing and Nancy, 2009). The most common standards used to assess water quality relate to drinking water, safety of human contact and for the health of ecosystems. Environmental water quality, also called ambient water quality, relates to water bodies such as lakes, rivers, and oceans. Water quality standards vary significantly

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due to different environmental conditions, ecosystems, and intended human uses. This study was to report on the assessment of the physicochemical parameter of the water sample from three major coconut husk retting areas of Kanyakumari dist.

Materials and Methods

Sample collection

Coir retting pond effluents were collected from three different locations such as Rajakamangalam, Inayam and Kollemkode regions of Kanyakumari District, Tamil Nadu, India. Effluent were collected in large sterilized bottles and brought to the laboratory. The physical parameters of water sample were distinguished by the colour, turbid and smell in sample. Turbidity was analyzed by Turbidity Meter tubes.

Physico-chemical analysis

Physico-chemical analysis of the effluent was carried out according to standard methods of American Public Health Association (APHA, 1992). The physicochemical parameter such as pH, phosphate (PO4P), nitrite (NO2N), nitrate (NO3N) were measured according to the standard procedures (APHA, 1998~ Grasshoff, 1983). Flame photometer (Model Systronic 128) was used for determination of metal ions Na+, K+ and Ca2+. Silver nitrate method was used to estimate the chloride present in water samples. Sulphate was determined by turbidimetric method.. Magnesium content can be determined from the value of total hardness and calcium hardness of water. Ammonia was determined by direct nesslerisation method. Water characteristic of dissolved oxygen (DO) was estimated Winkler's methods and Sulphide (Strickland *et al.,* 1972). BOD determination was based on the dissolved measurement. Chemical oxygen demand (COD) were estimated according to the procedure of Vogel (1978).

Results

The results of different physicochemical parameters of three selected coir retting ponds are shown in table 1. The results clearly indicated that all the three ponds were produced brownish yellow colour in all seasons. But the temperature varies from one place to other. Likewise, the transparency of the water column was also varies in these places.

Table – 1. Physic chemical parameters of three coconut husk pond ecosystems

Parameters	Range		
	Pond I	Pond II	Pond III
Colour	Colour Brownish yellow	Colour Brownish yellow	Colour Brownish yellow
Temperature ^{0}C	26.0 to 32.0	30.0 to 32.0	26.2 to 32.0
pH	4.4 to 6.8	4.2 to 6.6	4.5 to 6.2
Transparency (cm)	18.0 to 39.1	16.0 to 37.0	20.0 to 70.0
Free carbon-di-oxide	88 to 120	92 to 126	90 to 132
Total suspended solid (g/l)	0.09 to 0.19	0.10 to 0.17	0.08 to 0.18
Carbonate	Nil	Nil	Nil
Bicarbonate	128-150	120-148	116-146
BOD	180-240	188-236	182-240
COD	382-482	360-472	374-480
DO mg/l	2.4 to 3.9	1.8 to 3.3	2.2 to 3.2
Total phosphorus	46-56	40-54	46-54
Inorganic phosphate	28-38	28-36	24-30
Organic phosphate	18-Oct	16-Sep	16-Oct
Nitrate mg/l	200-278	198-264	180-256
Nitrite mg/l	25 to 56	21 to 52	22 to 48
Ammonia mg/l	440-512	428 to 499	414 to 491
H_2S mg/l	2.04 to 5.06	2.05 to 5.06	2.05 to 5.07
Calcium	76.4-96.7	62.8-90.2	60.4-86.4
Magnesium	10.12-19.67	08.04-16.28	08.2-17.42
Chloride	212.8-330.9	206.2-326.0	200.8-318.4

Discussion

The oxidation of organic matter is highly influenced by the temperature of water. Temperature of water depends upon the season, climatic zone, where

river is flowing, time of sampling and also upon the temperature of the effluents, which are being added in the ponds. During August 2010 to July 2011 temperature fluctuation was between 26 ° C and 32 ° C at pond - I and from was 22 ° C and 30 ° C at pond II. The minimum temperature was recorded in Jan 2011 at pond II and maximum in May 2011 at pond I. The same observations were also reported by Sharma *et al.,* (2011) and Shraddha *et al.,* (2008) in Narmada river and reported that the water temperature of Narmada river at Hoshangabad was recorded between 27.6°C to 38.4°C.

Turbidity has been long known to hinder disinfection by shielding microbes, some of them perhaps pathogens. This is most important significance of turbidity monitoring and therefore it has been an indication of effectiveness of filtration of water supplies (Hauser 2001). During August 2010 to July 2011 turbidity was fluctuated between 18 and 39 at station I and from 16 and 37 at station II, with minimum in May 2011 at station II and maximum in July at station II . These observations were also supported by Prasanna and Panda (2010), Shraddha *et al.,* (2008) and Trivedi *et al.,* (2009).

pH is an important parameter which is important in evaluation the acid base balance of water. Natural waters generally have been found to range from 5.5 to 8.6 because of the presence of bicarbonates and carbonates of alkaline earth metals. Drinking water with a pH range from 6.5 to 8.3 has been necessary. During August 2010 to July 2011 the pH was fluctuated between 4.6 to 6.6 at station I and was 4.2 to 6.2 at station II, with minimum in minimum in August 2010 and maximum in May 2011. Sharma *et al.,* (2011) observed pH fluctuation between 7.6 to 9.9 in Hoshangabad area of Narmada river. Prasanna and Ranjan (2010) observed pH value between 7.5 to 8.5 in Dharma estuary.

Biochemical oxygen demand is the amount of oxygen utilized by microorganism in stabilizing the organic matter in aerobic condition. DO measurement forms the basis of BOD analysis. It gives an indication of load of biodegradable organic material present in the water body. During the present study the DO was fluctuated between 2.4 mg/l to 3.9 mg/l at station I and between 2.2 mg/l and 3.2 mg/l. The minimum BOD was recorded January 2011 at station I and maximum in May 2011 at station II. Same observations were also recorded by Nnaji et al., (2010) and Mary et al., (2010).

The total solids are the total amount of chemical substance present in the water. The total dissolved solids and total suspended solids together make the total solids in the water. The presence of solids in water vary greatly at different times and affect the density of water and there by the quality of aquatic environment. During August 2010 to July 2011 the value of total solids varied from 230 mg/l to 345 mg/l at station I and 190 mg/l to 360 mg/l at station II. The minimum value was recorded in January 2011 and maximum in July 2011 at station II. Nduka et al., (2008) also recorded total solids between 100 to 220 mg/l in Niger delta of Nigeria.

Chlorides occur naturally in all types of waters, in Natural freshwaters, however, their concentration remains quite low and generally less that of sulphate and bicarbonate. Higher concentration of chlorides is considered to be the indicator pollution due to higher organic waste of the animal origin or industrial effluents. In the present study results have been coinsides with the results of Siraj et al., (2010).

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