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BIOREMEDIATION OF ORGANIC GASSES FROM WASTE WATER OF FOOD INDUSTRIES

Chemistry

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ABSTRACT

Waste water treatment is done biologically. For this two different types of Bio-filters with same size are used. First Bio-filter contains nutrients with packaging material for microorganism growth while second Bio-filter is without Nutrients. It is observed that the organic gasses present in waste water from dairy and food processing industry, efficiently removed by first bio-filter. First bio-filter shows 99% efficiency while second bio-filter shows only 75%efficiency. In first bio-filter with nutrients micro-organism grow which helps to oxidize organic gasses fast.

KEYWORDS

Biological, Waste water, Organic gas

INTRODUCTION

One of the important environmental problems is surface water pollution.

Two types of large and long-lasting pollution causes can be recognized at the global level:first, organic pollution leading to high organic content in aquatic ecosystemsand second in the long term, to eutrophication. It is known that polluted water has low quality thus restricting use of water bodies for many purposes.

When large number of organic compounds from many sources are released into the receiving running waters, lakes and also seas then organic pollution occur. Organic pollution produces from domestic sewage (raw or treated), or urban runoff, industrial effluents and farm water. biological pollution could negatively affect the water in many ways. Polluted waste water contains large amounts of suspended solid which stops the light available to photosyntheticorganisms mainly green aquatic plants. Organic wastes from people and animals are also richin disease causing (pathogenic) organisms [1, 2, and 3].

The mechanism of removal of organic matter by bacterial oxidation and the oxidation is taking place or during the oxidation metabolism the organic matter is used as asource of energy and as a source of synthesis of plant storage. So, in these cases the ways organic matter will be utilized.

MATERIAL AND METHODS

Recently, green aquatic plants have become significant organisms for bioremediation of waste water since they are able to accumulate plant nutrients, heavy metals, pesticides, organic andinorganic toxic substances and radioactive matters in their cells/bodies [4-9]. Bioremediation with micro aquatic plants have particularly gained importance in last 50 years and it is now widely accepted that bioremediation is as effective as conventional treatment systems. These specific features have made bioremediation and significant cheap alternatives to complex expensive treatment systems particularly for municipal waste waters treatment.

Aquatic green microbes harvested from polluted ponds are widely used as nitrogen and phosphorus supplement for irrigation purpose and can be subjected to fermentation in order to obtain energy from methane. Green aquatic plants are also able to absorb heavy metals and organic substances such as selenium, zinc and arsenic in their cells and/or bodies thus eliminating such substances from aquatic environments. Radiation is also a type of pollution as some water contains naturally radioactive materials, and others become radio active through contamination. Many green microbes can take up and use many radioactive minerals in their cells even from greater concentrations in the water [10]-[16]. According to MacKenthun, some microbes can accumulate radio-phosphorus by a factor 850 times that of water [17].

Micro-organism with these all abilities purify the polluted waters of many types and it is worth to emphasize that bioremediation technology in treatment of water systems are expected to get even more common in future years.

Treatment of wastewater which is applied to improve or upgrade the quality of a polluted water involves physical, chemical and biological processes in primary, secondary or tertiary stages. Primary treatment includes the physical processes of screening, sedimentation, grit removal and comminutions to remove materials that will either float or readily settle out by gravity. While the secondary treatment is usually carry out biologically and removes the soluble organic matter and suspended solids left from primary treatment. Tertiary or advanced treatment is process for purification in which nitrates and phosphates, as well as fine particles are removed [18]. However initial cost and operating cost of waste water treatment plant including all steps, is highly expensive [19].

Microbes have an important role in bioremediation of organic pollution in natural waters [20]. Moreover, many studies revealed that microbes remove nutrients especially nitrogen and phosphorus, heavy metals, pesticides, organic and inorganic toxins, pathogens from surface water by accumulating and/or using them in their cells[21]-[29]. Also, studies show that phytoremediation may be used successfully for waste water treatment as a result of their bioaccumulation abilities [30].

So this type of treatment can be used to remove organic materials from water. Here we will see the efficiency of bio-filter with nutrients and without nutrients.

This experiment is done in bio-filter with various nutrients. That is built up with two sets of Plexiglass column with a diameter of 0.01 m and a height of 0.2 m, 0.6 m, 1 m and 1.2 m. Wood bark filled in each column as packing material. Air passed through a wash flask and bubble column, before entering the filter, which served as humidifier. Flow rate can be measured with an anemometer. The moisture content of the filter material is measured by difference in weight between samples before and after drying at 110^{0}C. Organic gas concentration were measured according to Sawicki et al.(31)

The main objective of the process is the evaluation of nutrient supplementation. During 14 weeks more, regular and larger mean elimination efficiency is obtained for bio-filter 99%. The GC-MS analyses are performed by a Perkin-Elmer Mass Spectrometer is used with an automatic thermal desorption system. Tenax GC Tubes is used to absorb air samples.

The effect of nutrient solution has been investigated using two identical filters-column with wood peel as packing material. Following substance present in the nutrient solution:NaH_2PO_4 0.2 g/L; Na_2HPO_4 0.8g/L, $CaSO_4.H_2O$ 0.0g/L, $MgSO_4.7H_2O$ 0.5 g/L, $FeSO_4.7H_2O$ 0.01 g/L.

(Bio-filter 1) first 14 day daily than weekly 50 mL of the nutrient solution is supplied, while at the same time second bio-filter (Bio-filter 2) is operating without nutrient solution.

Bio-filter (filter bed height of 1 m, pH 6.5 and a moisture content of 60 %) are loaded with a synthetic waste gas, containing about 10 ppm (v/v) of organic compound.During fourteen weeks the biofilters are loaded with the aldehyde(butanal) at a volumetric load of $100m^3/m^2h$. Aldehyde concentration is measured at four height(0.2m, 0.6m, 1.0m and 1.2m) during this period. The results are expressed as the elimination efficiency, calculated as follows (Table 1) (Figure 1)

η- (1- c_i/c_o) x100 (%)

η- The elimination efficiency
c_i – Aldehyde concentration measured at height I in Bio-filter
c_o – Aldehyde input concentration

Table 1

	Bio filter 1 (with nutrients)				Bio-filter 2 (without nutrients)			
Time (week)	Height 0.6m	Height 1.0m	Height 1.2m	Height 0.2m	Height 0.6m	Height 1.0m	Height 1.2m	Height 0.2m
1	43	74	80	5	23	52	70	2
2	44	75	85	5	24	53	71	2
3	45	75	87	5	25	55	72	2
4	46	76	88	6	26	56	72	3
5	46	77	90	7	26	56	73	3
7	47	78	93	7	27	57	73	3
9	48	79	95	8	28	57	74	4
10	50	80	97	8	30	58	75	4
12	52	80	99	9	32	58	75	4

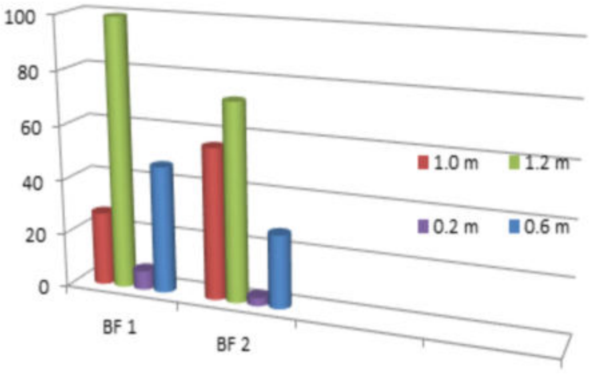

Figure 1- Efficiency of Bio-filter 1(BF1) And Bio-filter 2(BF2)

CONCLUSION

Organic compoundis eliminated from odorous air by wood bark bio-filter in lab scale is in high elimination efficiency. In presence of nutrient micro-organism growth is good. So the effect shows the efficiency of the elimination of organic compounds from polluted gas.

Possible reasons for this effect are pH stabilization or may be nutrient balance for micro-organism growth.

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