Chemistry and Materials Research
ISSN 2224- 3224 (Print) ISSN 2225- 0956 (Online)
Vol.9 No.2, 2017

Preliminary Study of the Potential Industrial Applications of Micro Algae (Oscillotoria sp.) Oil

Chinweuba A.J[1] Alisa C.O[2] Okoye U.G[1]
1. Department of Chemistry, Chukwuemeka Odumegwu Ojukwu University,Uli. P.M.B 02, Nigeria
2.Department of Chemistry, Federal University of Technology, Owerri

Abstract
Extraction and characterisation of micro algae (*Oscillotoria sp*) were done to assay the possible industrial applications of the oil. An open pond system was used to culture the microalgae prior to the oil extraction. Solvent extraction method using n-hexane was used to extract the oil from the algae biomass. The physical and chemical properties of the oil were determined and the results obtained showed that the percentage oil yield was 28. Saponification value of 123mgKOH, iodine value 95g/100g, free fatty acid value of 3.79mg/g and peroxide value of 3.20meq/kg were also obtained. These values showed that *Oscillotoria sp* oil could be used industrially for the production of alkyd resins, paint polish and body cream.
Keywords: Oil, *Oscillotoria sp*., applications and algae.

1.0 Introduction

Algae are unicellular or multicellular organisms that photosynthesize but lack features such as leaves, roots, seeds and flowers of the higher vascular plants. These organisms are studied by algologist in a field known as algology. (Nabors2004). Micro algae contain lipids and fatty acids as membrane components storage products, metabolites and sources of energy. Algal fatty acids and oils have a wide range of potential applications; algal oil posses characteristics similar to those of fish and vegetable oil. (Patil, Tran,and Giselrod. 2008) Microalgae are capable of generating widest range of biofuels comprising of ethanol, methane and hydrogen. Several species of algae are raised for food example purple laver (porphyra) is perhaps the most widely domesticated marine algae used as food in some Asian countries. (Mumford and Miura, 1988).Sprinulina (*Anthrospira platensis*) is blue green algae with long history as food source in East Africa and Mexico. Sprinulina is high in protein and other nutrients. Chlorella is another popular micro algae used as food source in Japan. (Mumford and Miura, 1988). Algae can be used in making fertilizer and certain species of algae can be land applied as an organic fertilizer either in raw or in semi decomposed form. (Thomas 2002). Algae have served as source of potassium for the manufacture of potash and potassium nitrate for centuries.

Oscillotoria is a genus of filamentous cyanobacterium which is named for the oscillation in its movement. Filaments in the colonies can slide back forth against each other until the whole mass is reoriented to its light source. Oscillotoria reproduces by fragmentation and is usually found in watering troughs water. Usually it is mainly blue green or brown algae in colour. (Wikepedia , 2014). *Oscillotoria sp* uses photosynthesis to survive and it is the subject of research into natural production of butylated hydroxytoluene, an antioxidant, food additives and industrial chemical. (Buba and Wu, 2008).

This paper outlines the physiochemical properties of *Oscillotoria sp* oil and its possible industrial applications.

2.0 Methods

Oscillotoria sp was collected from a garden in Onitsha by carefully removing the holdfast from the substrate with fingers and was gently placed into containers with sufficient habitat water in order to maintain natural environment for algae.

2.1 Oil Extraction and characterisation

The algae biomass was harvested with the aid of a chemical flocculants, alum. The algal biomass was filtered with a clean white cloth; sun dried for 4 days and was ground prior to extraction. The oil was extracted by solvent extraction method with Soxhlet extractor and n-hexane as the solvent.

The percentage oil yield was calculated from the ratio of mass of oil to the mass of ground micro algae used for the extraction. Peroxide, acid, iodine, saponification and free fatty acid values were determined by standard methods described by Lambert and Muir 1968.

2.2 Formulation of alkyd resins

Alkyd resin was produced from *Oscillotoria sp* oil using alcoholysis method. *Oscillotoria sp*. oil 23.05%, phthalic anhydride 43.00% and glycerol 33.85% were refluxed under carbon IV oxide with continuous stirring at 240^{o}C until alkyd resin were formed. (Borax and Van Fraunhofer. 1980).

2.3 Polish Formulation

Bee wax 6.9% and paraffin wax 20.83% were melted, oscillotoria sp. oil 13.89% and paraffin oil 13.89% were added with continuous stirring. To the mixture, turpentine 41.67% and carbon black 1.39% were added. The liquid was poured into a container and allowed to solidify over time. (Ajiwe, Okeke, Nnabuike, Ogunleye and Elebo. 1997).

2.4 Paint Formulation

The resin formed from *Oscillotoria sp.* oil 34.1%, mineral oil 22.0%, thymol 0.2%, titanium oxide / calcium carbonate 22.1% and turpentine 20.0% were mixed and stirred continuously to form paint.(Chukwumaobi, 1987).

2.5 Formulation of body cream

4.75g *Oscillotoria sp*. oil was mixed with 2.0g of emulsifying wax, 1.0g of stearic acid and 0.7g cetyl alcohol. The mixture was heated to 70^{o}C and a mixture of 15g water, 1.70g glycerine and 5.0g sodium stearate was added with continuous stirring. 0.8g of Sodium benzoate, 0.2g methyl paraben, and 0.5ml of propylene glycol were added and stirred to form cream. (Ajiwe et.al. 1997).

3.0 Results

Table I: Physical and chemical characteristics of *Oscillotoria sp.* oil.

Properties	Values
Color	Green
Odor	Pleasant
Solubility	Immiscible with water
State at room temperature	Liquid
Acid value(mgNaOH/g)	7.58
Free fatty acid (%)	3.79
Iodine value (g/100g)	95.00
Saponification value(mgKOH)	123.00
Peroxide value (meq/kg)	3.20
Oil yield (%)	28.00

4.0 Discussion

The physiochemical properties of *Oscillotoria sp*. oil are shown in table 1. The percentage oil yield of 28 compared favourably with some known oils used in industries examples Cassava 23 – 25%, sunflower 25-28%, cotton 18 – 28%, and soya bean 11-25%. *Oscillotoria sp*. oil had iodine value of 95g/100g which classified the oil to be a drying oil thus confirmed it's suitable for industrial production of paints, alkyd resin, polish and cream. The low peroxide value of 3.20meq/kg showed that the degree of oxidation in the oil was low, which made the oil not to have awful smell. Acid value of oil gives indication of its freshness and edibility. The acid and free fatty acid values of 7.5mgNaOH/g and 3.79 respectively showed that *Oscillotoria sp* oil to be inedible and would require little or no purification in the production of alkyd resin, paint, polish and cream. The low values of acid and free fatty of *Oscillotoria sp*. oil also suggested that the oil would have long shelf life. (Ajiwe et.al; 1997).

5.0 Conclusion.

All products produced from *Oscillotoria sp*. oil compared favourably with the commercial available ones in the local market; thus the oil could be used for commercial production of paints, alkyd resin, polish and body cream.

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