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The AERONET (AErosol RObotic NETwork) program is a federation of ground-based remote sensing aerosol networks established by NASA and PHOTONS (PHOtométrie pour le Traitement Opérationnel de Normalisation Satellitaire; Univ. of Lille 1, CNES, and CNRS-INSU) and is greatly expanded by networks (e.g., RIMA, AeroSpan, AEROCAN, NEON, and CARSNET) and collaborators from national agencies, institutes, universities, individual scientists, and partners. For more than 25 years, the project has provided long-term, continuous, and readily accessible public domain database of aerosol optical, microphysical and radiative properties for aerosol research and characterization, validation of satellite retrievals, and synergism with other databases. The network imposes standardization of instruments, calibration, processing and distribution.

AERONET collaboration provides globally distributed observations of spectral aerosol optical depth (AOD), inversion products, and precipitable water in diverse aerosol regimes. Version 3 AOD data are computed for three data quality levels: Level 1.0 (unscreened), Level 1.5 (cloud-screened and quality-controlled), and Level 2.0 (quality-assured). Inversions, precipitable water, and other AOD-dependent products are derived from these levels and may implement additional quality checks.

The AERONET - Ocean Color (AERONET-OC) is another component of the AERONET program, provides the additional capability of measuring the radiance emerging from the sea (i.e., normalized water-leaving radiance) with sun-photometers installed on offshore platforms like lighthouses, oceanographic and oil towers. Similarly, the Maritime Aerosol Network (MAN) component of the AERONET program provides ship-borne aerosol optical depth measurements from the Microtops II sun photometers. These instruments have been deployed periodically on ships of opportunity and research vessels to monitor aerosol properties over the World¿s Oceans. The Solar Radiation Network (SolRad-Net) provides high-frequency solar flux measurements and is collocated with AERONET sites.

The processing algorithms have evolved from Version 1.0 to Version 2.0 and now Version 3.0. The Version 3 databases are available from the AERONET and PHOTONS web sites. Version 2 data may be downloaded from the web site through 2018 and thereafter upon special request. New AERONET products will be released as new measurement techniques and algorithms are adopted and validated by the AERONET research community. The AERONET website also provides AERONET-related news, a description of research and operational activities, data visualization, web services, related Earth Science links, and an AERONET staff directory.

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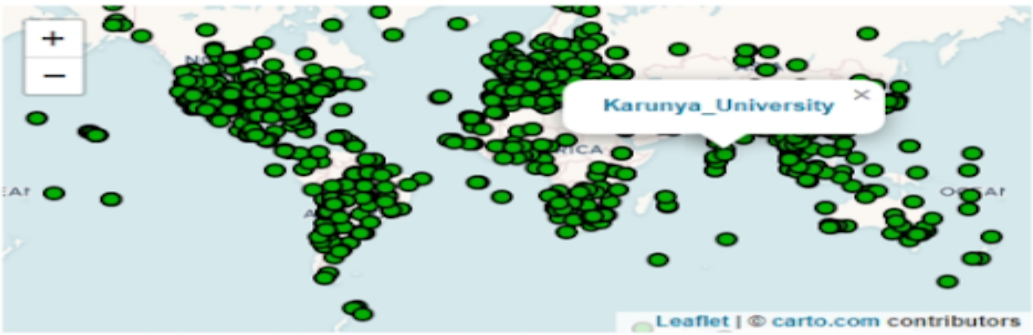

ANNOUNCEMENTS

26 July 2023

The AERONET-OC data (Normalized Water Leaving Radiance) procedure of raising from Level 1.5 to Level 2.0 changed starting on July 2023. Previously expert-based quality control procedure (Zibordi et al. 2021) was applied to the qualified data (with final calibration and corresponding Level 2 AOD). Now the automated quality control procedure (Zibordi et al. 2022) is applied to all data not formerly quality controlled by March 2022 and upcoming data.

Zibordi, G., Holben, B. N., Talone, M., D'Alimonte, D., Slutsker, I., Giles, D. M., & Sorokin, M. G. (2021). Advances in the ocean color component of the aerosol robotic network (AERONET-OC). *Journal of Atmospheric and Oceanic Technology, 38*(4), 725-746.

Zibordi, G., D'Alimonte, D., & Kajiyama, T. (2022). Automated Quality Control of AERONET-OC LWN Data. *Journal of Atmospheric and Oceanic Technology, 39*(12), 1961-1972.

10 November 2021
+ NASA Hyperwall AERONET presentation at COP26

23 July 2019
+ DRAGON FIREX-AQ

12 February 2019
+ Inversion Uncertainty Estimates and Provisional Lunar AOD Announcement

11 January 2019
+AERONET Version 3 manuscript published in Atmospheric Measurement Techniques

+ More Announcements

Aerosol Optical Depths during 2023 Canadian Wildfires

The ongoing 2023 Canadian wildfires, which started at the beginning of March and peaked during the month of June, have released massive amounts of aerosols and gases in the atmosphere that darkened the skies of major cities in eastern North America, such as Chicago, Washington D.C., New York City, and Montreal. The AERONET network in North America is monitoring and making continuous measurements of atmospheric aerosols, which can help understand their influence on local and regional air quality and their longer-term impact on climate. AERONET maintains a wide array of evenly distributed sun photometer sites with instruments that record optical depths and publish those measurements in near real-time. The animated map shows the daily average aerosol optical depth (AOD) at 500 nm from June 26th to July 2nd, 2023, measured across AERONET sites in the contiguous United States and southern Canada.

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FORM 2
THE PATENTS ACT, 1970
(39 of 1970)
&
The Patents Rules, 2003

COMPLETE SPECIFICATION
(See section 10 and rule 13)

TITLE OF THE INVENTION

Biosynthesis of Isopropyl myristate

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PREAMBLE TO THE DESCRIPTION

The following specification particularly describes the invention and the manner in which is to be performed.

FIELD OF TECHNOLOGY

This disclosure relates to generally to isopropyl myristate synthesis and in particular to biosynthesis of isopropyl myristate using bacteria.

BACKGROUND

EUROPEAN PATENT PUBLICATION 0383405A1 in Para 0011 describes that isopropyl myristate was prepared by charging myristic acid (98%; 50 kg) and propane-2-ol (13 kg) into a 100 litre stirred tank reactor equipped with heating coils, condenser and vacuum facility. The reactants were heated with stirring to 60°C and 1 kg lipase enzyme (code SP382, ex NOVO Industries, lipase catalyst from Candida species immobilised on acrylate beads) was added. The reaction was continued at 60°C and 20.000 Pa. pressure by dosing further propane-2-ol at 5 kg/hr to replace the distilling propane-2-ol/water azeotrope until the acid value of the product was 0.5. Excess propane-2-ol was then removed under reduced pressure and the product isopropyl myristate separated from the enzyme by filtration. The resulting product showed excellent colour (10 APHA) and had no odour. Product yield was better than 99%. There are several disadvantages associated with the synthesis of isopropyl myristate as known in prior art and the object of the current disclosure is to ameliorate those defects.

SUMMARY

Embodiments of the present disclosure are related to a biosynthesis of Isopropyl myristate using bacteria and method of purifying arsenic contaminated water using the prepared Isopropyl myristate.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of nature and desired objects of the present invention, reference is made to the following detailed description taken in conjunction with the accompanying drawing figures wherein like reference character denote corresponding parts throughout the several views. Objects, features, and advantages of embodiments disclosed herein may be better understood by referring to the following description in conjunction with the accompanying drawings. The drawings are not meant to limit the scope of the claims included herewith. For clarity, not every element may be labelled in every Figure. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating embodiments, principles, and concepts. Thus, features and advantages of the present disclosure will become more apparent from the following detailed description of exemplary embodiments thereof taken in conjunction with the accompanying drawings in which:

FIGURE 1 illustrates an exemplary block diagram of a method of generating Isopropyl myristate in accordance with the present disclosure;

FIGURE 2 illustrates an exemplary method of purifying arsenic contaminated water using Isopropyl myristate accordance with the embodiments of the present disclosure; and

FIGURE 3 illustrates an exemplary process showing the preparation of IPM in accordance with the embodiments of the present disclosure.

DETAILED DESCRIPTION

Hereinafter, various embodiments of the present disclosure will be described with reference to the accompanying drawings. It should be noted that all of these drawings and description are only presented as exemplary embodiments. It is to note that based on the

subsequent description, alternative embodiments may be conceived that may have a structure and method as disclosed herein, and such alternative embodiments may be used without departing from the principle of the disclosure as claimed herein.

It may be appreciated that these exemplary embodiments are provided herein only for enabling those skilled in the art to better understand and then further implement the present disclosure and is not intended to limit the scope of the present disclosure in any manner. Besides, in the drawings, for a purpose of illustration, optional steps, modules, and units are illustrated in dotted-line blocks.

The terms "comprise(s)," "include(s)", their derivatives and like expressions used herein should be understood to be open, i.e., "comprising/ including, but not limited to." The term "based on" means "at least in part based on." The term "one embodiment" means "at least one embodiment"; and the term "another embodiment" indicates "at least one further embodiment." Relevant definitions of other terms will be provided in the description below.

In one embodiment a method generating isopropyl myristate (IPM) may include preparing a fermented broth, the IPM production medium, at a PH of 7 by inoculating with a Gram-positive non-pathogenic soil bacterium using a basal medium containing sucrose. In a further embodiment, the Gram-positive non-pathogenic soil bacterium using a basal medium containing sucrose is fermented for at least 3 days at a temperature of 30^{o} C by shaking at regular intervals at 120 rpm. In a further embodiment, the Gram-positive non-pathogenic soil bacterium is *Bacillus sonorensis* (*Bacillus Sp.).* In a further embodiment, the fermented broth is heated at 100^{o} C for about 10 minutes and then centrifuged at 4^{o} C at about 15000 rpm for about 10 minutes. In a further embodiment, Isopropyl alcohol and the fermented broth is mixed in a ratio of 1:1. In a further embodiment, the supernatant equal volume of ice-cold isopropyl alcohol was

kept at about 4^{O} C overnight, for about 8 to 10 hours. In a further embodiment, the precipitate was collected by centrifuging at about 15000 rpm at a temperature of 4^{o} C for about 10 minutes. In a further embodiment, the collected precipitate pellet collected contains IPM.

A further embodiment includes purifying water containing arsenic using the crude IPM synthesized using the above method. In a further embodiment, 1 mg/mL concentration of IPM is prepared by dissolving in distilled water of pH-7. In a further embodiment, a homogenate IPM solution of 1 mg/mL was transferred to a dialysis bag of 12 KD. In a further embodiment, the dialysis bag filled with IPM solution was brought in contact with an aqueous solution containing arsenic (As) in a volume of 1mg/L. In a further embodiment, the contact was for a period of 8 hours at a temperature of 25^{o} C, and periodically shaking at 120 rpm, wherein the IPM acts as a bio-adsorbent to adsorb As(V). In a further embodiment, after 8 hours the dialysis bag is transferred to distilled water of pH-7 and kept in a shaker at 120 rpm for 4 hours at 25^{o} C, which facilitates removing the unbound As(V) to the surface of the dialysis bag. In a further embodiment 0.08mg/L of As(V) was found bound with 1mg/mL of IPM used.

In a further embodiment, bacteria have the ability to metabolize hazardous material like arsenic from the contained environment. In a further embodiment, Gram's positive bacterium PS-7 from non-arsenic contaminated source. Wherein the bacterium showed tolerance to arsenic up to 1000mg/L of As(V) and As(III). In a further embodiment, the bacterium showed arsenic adsorbing potential its surface with 98 % of As(V) and 97% of As(III). In a further embodiment, the bacterium exhibit lithotrophic potential of growing in nutrient depleted medium with an elevated concentration of As(V) and As(III). In a further embodiment, based on the phenotypic and genotypic (16s rRNA) sequencing strain the PS-7 was identified as *Bacillus sonorensis.*

In a further embodiment, bacterial isolates were inoculated in arsenic-containing media and with varying final concentration 1 mg/L to 5mg/L and incubated at 30˚C for 24 hrs at 150 rpm. In a further embodiment, cells were separated by centrifugation at 10000 rpm for 5 min and concentration of arsenic in the cell-free supernatant was determined by AAS. In a further embodiment, the effect of pH in arsenic removal was determined by varying levels of 2-14 with an initial concentration of 5mg/L concentration of As(III) and As(V).In a further embodiment, the percentage of arsenic removal was calculated according to the formula:

$$\frac{(C_{As}^{I} - C_{As}^{F})100}{C_{As}^{I}}$$

Where C^{I}_{As}, C^{F}_{As} are the initial and final arsenic concentrations, respectively.

In a further embodiment, bacterial bioremediation of arsenic may be a promising method for industrial and environmental inorganic arsenic contaminants in water and soil. In a further embodiment, it may be noticed that irrespective of prior arsenic exposure *Bacillus sonorensis* PS-7 that shows hyper resistance up to 1000mg/L concentration of As(III) and As(V), Identified strain PS-7 shows promising adsorption of 98% free arsenic. In a further embodiment, halotolerance and resistance to other metals like zinc, lead, nickel and titanium make this bacterium a potential candidate for a wide range of environmental remediation.

Reference is now made to Figure 1, which discloses a method of preparing IPM in accordance with the embodiments of present disclosure. The first step is the production of the broth i.e., the IPM production medium, as a pH7. Next step is inoculation of Gram-positive non-pathogenic soil bacterium, *Bacillus sonorensis* or *Bacillus Sp*. Next, the bacterium is inoculated in a basal medium containing sucrose and is fermented for at least 3 days at a temperature of around 30^{o} C by shaking it at around 120 rpm. Next, the fermented broth is heated at 100^{o}C for about 10 minutes and then centrifuged at around 4^{o}C, wherein the centrifuge speed is around

15000 rpm from about 10 minutes. Next, to the supernatant equal volume of ice-cold isopropyl alcohol mixed and kept at 4^{o}C overnight for about 8 – 10 hours. Next, the precipitate was collected by centrifuging around 15000 rpm at 4^{o}C for about 10 minutes. The pellets that are collected contain IPM.

In one embodiment, the IPM production media contains the following composition Sucrose about 10 grams; malt extract about 3 grams; peptone about 5 grams; $MgSO_4$ about 1 g; K_2HPO_4 about 0.3 grams and distilled water of about 1000 mL

Reference is now made to Figure 2A, which is a method of purifying water contaminated with arsenic using the synthesized IPM in accordance with the embodiments of the present disclosure. 1mg/mL concentration of IPM is prepared by dissolving it in distilled water of pH-7. A homogeneous solution of IPM of 1mg/mL is transferred into a dialysis bag of 12 KD. The dialysis bag filled with the IPM solution is brought into contact with an aqueous arsenic solution As(V) of 1mg/mL for about 8 to 10 hours, shaking it at 120 rpm at 25^{o}C, wherein the purpose of the IPM is to act as a bio-adsorbent configured to adsorb As(V) from the aqueous solution. After about 8 hours the dialysis bag is transferred to distilled water of pH-7 and kept in a shaker at 120 rpm for about 4 hours at 25 ^{o}C, wherein the unbound As(V) on the surface of the dialysis bag is removed. It was then determined that about 0.08mg/L of As(V) were found with 1mg/mL of IPM. Also shown in Figure 2B is the quantitative analysis of untreated water and As(V) contaminated water that is treated.

In some embodiments, Isopropyl myristate (IPM) an ester of fatty acid used as an emulsifying agent and is prepared traditionally by a chemical method in the presence of fatty acid and isopropyl alcohol (IPA). In some other embodiments, biological method of preparing IPM may be achieved by enzyme lipase from bacteria and fungi in the presence of precursors

like myristic acid and IPA. In accordance with the embodiments of the present disclosure, IPM is produced by adding IPA to bacterial medium containing no added IPM precursors like fatty acid and myristic acid as shown in Figure 3.

The accompanying figures and description depicted and described embodiments of the present disclosure and features and components thereof. Those skilled in the art will appreciate that any particular program nomenclature used in this description was merely for convenience, and thus the present disclosure should not be limited to use solely in any specific application identified and/or implied by such nomenclature. Thus, for example, the routines executed to implement the embodiments of the invention, whether implemented as part of an operating system or a specific application, component, program, module, object, or sequence of instructions could have been referred to as a "program", "application", "server", or other meaningful nomenclature. Indeed, other alternative hardware and/or software environments may be used without departing from the scope of the invention. Therefore, it is desired that the embodiments described herein be considered in all respects as illustrative, not restrictive, and that reference be made to the appended claims for determining the scope of the invention.

Although embodiments of the invention have been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

ABSTRACT

Disclosed is a method of synthesizing IPM using bacteria and using the synthesized IPM for purifying water contaminated with arsenic.

I/WE CLAIM

1. A method synthesizing and preparing isopropyl myristate (IPM), the method comprising - preparing a fermented broth by inoculation with a Gram-positive non-pathogenic bacterium using a basal medium containing sucrose for a pre-defined period;
   - heating the broth for 100^{o} C for a pre-defined time;
   - centrifuging the broth at 4^{o} C at a speed in the range of 12000 – 18000 rpm;
   - mixing Isopropyl alcohol with the broth in a 1:1 ratio;
   - centrifuging the mixture of the alcohol and broth; and
   - collecting the precipitate containing IPM

2. The method as claimed in claim 1, wherein the Gram-positive non-pathogenic bacterium is a soil bacterium - *Bacillus sonorensis* (*Bacillus Sp*.)

3. The method as claimed in claim 1, wherein the pre-defined period of fermented is for at least 3 days at around 30^{o} C at a speed of 120 rpm in a centrifuge.

4. The method as claimed in claim 1, wherein the IPM production media comprises sucrose of about 10 grams; malt extract of about 3 grams; peptone of about 5 grams; $MgSO_4$ of about 1 g; K_2HPO_4 in about 0.3 grams and distilled water of 1000mL

5. The method of claim 4, wherein the compounds used for IPM production media can be proportionately increased or decreased and remain in the same ratio.

6. The method as claimed in claim 1, wherein the mixture of alcohol and broth is centrifuged for about 10 minutes at a speed of in the range of 12000 rpm to 15000 rpm at 4^{o} C to obtain a precipitate containing IPM.

7. A method of purifying water contaminated with arsenic using the IPM synthesized as claimed in claim 1, comprising
   -dissolving the synthesized IPM in distilled water at pH-7, wherein an IPM solution containing 1mg/mL is filled into a semi-permeable bag;

bringing into contact the bag containing IPM solution with 1mg/L concentration of arsenic As(V) containing the aqueous solution for 8 hours, wherein the IPM is a bio-adsorbent configured to adsorb the As(V); and

washing the bag for about 4 hours at about 120rpm to remove unbound arsenic on the surface.

8. The method as claimed in claim 7, wherein a percentage of IPM used is1mg/mL concentration in 1 mg/L concentration of arsenic in water.

9. The method as claimed in claim 7, wherein about 0.08mg/L of As(V) are bound to about 1mg/mL of IPM

FORM 5

THE PATENT ACT, 1970

&

THE PATENT RULES, 2003

DECLARATION AS TO INVENTORSHIP

[See section 10(6) and rule 13 (6)]

1.**NAME OF APPLICANT(S):KARUNYA ISNTITUTE OF TECHNOLOGY AND SCIENCES**

Hereby declare that the true and first inventor(s) of the invention disclosed in the complete specification filed in pursuance of my/our application numbered----------under title **"HOUSEHOLD COST EFFECTIVE BIOCOMPATIBLE NON UV NANOCOMPOSITE MEMBRANE BASED WATER PURIFICATION SYSTEM"** dated----------is/are

2. **INVENTOR(S)**

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3. **DECLERATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(S) IN THE CONVENTION COUNTRY:- N/A**

We the applicant(s) in the convention country hereby declare that our right to apply for a patent in India is by way of assignment from the true and first inventor(s)

Dated this day of 2021

Signature

Name of the signatory

4. **STATEMENT** (to be signed by the additional inventors not mention in the application form)

I/We assent to the invention referred to in the above declaration, being included in the complete specification filed in pursuance of the stated application.

Dated this 12th day of APR 2021

Signature :

Name : **DR.JEGATHAMBAL**

Signature :

Name : **DR. A. HEPZIBAH CHRISTAL**

Signature :

Name : **DR. R. EMILIN RENITTA**

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Name : **DR. MARTIN MKANDAWIRE**

Signature :

Name : **DR. STEPHANIE MACQUARRIE**

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Name : **DR. RAJENDRAN KALIAPERUMAL**

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