MULTIFUNCTIONAL MATERIAL FROM WASTE

Sonal Sanjay Dhabekar [a], Charita Patil[b]
[a]Principal Investigator, Women Scientist Scheme - B (WOS-B) , DST.
Department of Cosmetic Technology, Lady Amritabai Daga College for women of Arts, Commerce and Science and Smt Ratnidevi Purohit College of Home Science and Home Science Technology,,SeminaryHills,Nagpur,Maharashtra.,India.
Email id: saana_0204@yahoo.com
bAssociate Professor , Department of Chemisty , Lady Amritabai Daga College for women of Arts, Commerce and Science and Smt Ratnidevi Purohit College of Home Science and Home Science Technology,Shankar Nagar Nagpur , Maharashtra ,India.

A B S T R A C T

Day by day Environmental Pollution is on rise .There are many types of waste which can be recycled or reutilized in best way to design multifunctional materials from it. The multifunctional materials are the materials that perform multiple functions. The advantage of this type of approach is not only to reduce environmental pollution but also material cost. Orange peel is one such waste which is otherwise discarded as waste can be utilized to give multifunctional material. Using wax melt dispersion technique for encapsulation of orange peel oil provides multifunctional value addition in product performance.

Keywords: Environment, Pollution, Waste, Recycle, Multifunctional, Orange peel

Introduction

There are many types of waste which can be recycled for their properties. Orange peel and Rice bran wax are such two types of waste which are having potential in them to be used as functional material.

Fig -1 (a) Orange peel (b) Orange peel waste

Botanical Name : *Citrus reticulate*
Family : Rutaceae.
Mandarin Orange

The orange is one of the major citrus fruits.Approximately 40–60% of oranges are squeezed to juice and the remainder, containing peel, segment membranes and other by-products is considered as citrus processing waste(Mohammad Pourbafrani ,Farid Talebnia Claes ,Niklasson ,Mohammad & J. Taherzadeh,2007) (Grohmann K., Baldwin E.A,1992). The citrus outer peel, known as flavedo, has a large number of very small glands, each containing a minute drop of essential oils **.** (Amr M. Bakry ,Shabbar Abbas ,Barkat Ali,Hamid Majeed,Mohamed Y & Abouelwafa,Ahmed Mousa,2015).Their essential oils are a mixture of volatile compounds consisting mainly of monoterpene hydrocarbons and exist especially in citrus peels, flowers, and leaves. The citrus peel, which represents roughly half of the fruit mass, is a rich source of bioactive compounds Part of this waste is dried to be used as animal feed, but the drying process is costly due to the high moisture content of peels, and therefore a large proportion of waste has to be disposed of. This may result in many problems from both economic and environmental points of view including high transport costs, lack of disposal sites and high organic content. (Tripodo M.M., Lanuzza F., Micali G., Coppolino R., & Nucita F,2004).Residues obtained from citrus processing can yield: dried pulp and molasses, fiber, pectin, dietaryfibers, cold-pressed essential oil, essences, D-limonene, juice pulp, pulp wash, , seed oil,limonoids, and flavonoids like hesperidinetc. They are used in the production of human food and food

supplements, as a fermentation substrate for single-cell protein production, as silage, and as mosquito repellent. (James H. Clark , Lucie A. Pfaltzgraff, Vitaliy L. Budarin,Andrew J. Hunt, Mark Gronnow, Avtar S. Matharu, Duncan J. Macquarrie, &James R. Sherwood ,2013)

Rice bran wax

Rice bran wax is obtained from natural source (*Oryza sativa* -Family Graminae) and is abundantly available. It is an important byproduct of rice bran oil industry

Vidya Sabale ,P. M. Sabale & C. L. Lakhotiya(2007)

Fig -2 Rice bran Wax

Rice bran wax is the vegetable wax extracted from the bran oil of rice (Oryza sativa). Rice bran wax is a natural plant wax derived from rice bran which is a by produt of rice milling .The potential applications of Rice bran wax in the cosmetics , pharmaceutical, food , polymer are as cost efficient as those of other plant waxes , such as carnauba wax and candelilla wax.(G. Basarkar , G. Shirsath, & S. Patil ,2013)

Rice bran wax is edible and can serve as substitute for carnauba wax in most applications due to its relatively high melting point .

- Physical Properties : Melting Point : 77-86
- Color : Off – white to moderate orange / brown
- Odor: typical fatty.
- Chemical Composition
- The main components of rice bran wax are aliphatic acids (wax acids) and higher alcohol esters. The aliphatic acids consist of palmitic acid (C16), behenic acid (C22), lignoceric acid (C24), other higher wax acids. The higher alcohol esters consist mainly of ceryl alcohol (C26) and melissyl alcohol (C30). Rice bran wax also contains constituents such as free fatty acids(palmitic acid), squalene and phospholipids(Wikipedia)
- So as to use the above two types of waste waxmelt dispersion technique is used to prepare Orange Peel oil Rice bran wax Microparticles.
- *Method*
- Wax melt dispersion technique
- Pharmaceutical processing techniques, which offer freedom from organic solvents, are preferred due to stringent global requirements of quality.
- Hence many reports are published on techniques such as melt granulation, melt extrusion, , melt dispersion, and melt solidification. Lipids, waxes and polyethylene glycols are the most favorable carrier for these techniques. Drug is incorporated in in these carriers to achieve controlled release taste masking stability improvement or amorphous form Design and application of these techniques depend on physicochemical properties of the drug and excipients as well as desired properties of the final product. Wax, a common carrier in various melt techniques, contains wide group of chemicals such as glycerides, fatty acids, fatty alcohols and their esters. These are widely used as release retardant in the design of sustained release beads, tablets, suspensions, implants and microcapsules. The advantages of waxes include good stability at varying pH and moisture levels.

Melt solidification /melt dispersion technique basically involves emulsification of the molten mass in the aqueous phase followed by its solidification by chilling.A promising strategy involves the development of suitable drug carrier systems. Lipid particles based on triglycerides, waxes or fatty acids as matrix lipids are being intensively investigated as potential carrier systems, in particular for lipophilic substances. (B. Kamble, A. Kumar, K. Mahadik, &A. Paradkar,2010)

Experimental

- Food grade rice bran wax was melted at temp at 95° along with tween 80 (0.44 gm) and Span 80 (0.56 gm) was added and stirred thoroughly.

- Orange peel oil in 1:2 ratio in wax and this mixture was then added with distill water at 80°C to 85°C.The mixture was stirred (Remi stirrer India at 500rpm for 4 min) with three blade impellar.
- Then this mixture was cooled to 2°C to 8°C for 15 min then microparticles were collected by filteration washed with water and dried at room temperature for 48 hrs.
- **Result and Discussion** :
- Particle size : The particle size was found to be in range of 75 µm to 150µm.
- The orange peel oil rice bran wax microparticles can be incorporated in suitable base and unique pressure triggered mechanism during the application provides the multifunctional benefit. The wax will provide moisturizing effect t and encapsulates orange peel oil in it which provides mosquito repellencey because of its limonene content and various other properties like antimicrobial, antiacne, antidandruff and hair conditioning effect .
-
- Thus from the above study it is observed that there is feasibility of orange peel oil rice bran wax microparticles as an multifunctional material which can be incorportated in cosmetic formulations like gel , cream , lotion, ointment , shampoo etc . Pressure triggered release of Multifunctional Orange peel oil Rice bran wax microparticles can provides following benefit
- Moisturising
- Scrubbing
- Mosquito Repellency
- Antimicrobial
- Anti Acne
- AntiDandruff
- Hair Conditioner

Thus the present work is the combination of science and technology for using waste in best form with multifunctional benefits in the product .

Conclusion

The peel of oranges , which are generally discarded as waste in the environment, can act as potential resources. Due to their low cost and easy availability such wastes are capable of offering significant low-cost starting material . The utilization of these bioactive rich orange peel along with rice bran wax can provide an efficient, inexpensive, and environment friendly platform for the production of novel multifunctional materials with value added performance in product.

Acknowledgement

The author Dr. Sonal Sanjay Dhabekar acknowledges Department of Science and Technology (DST) India, for the financial support under the women scientist scheme – B for research fellowship grant no SR/WOS-B/645/2016.

Refrences

1. Mohammad Pourbafrani ,FaridTalebnia , ClaesNiklasson and Mohammad J. Taherzadeh , (2007),Protective Effect of Encapsulation in Fermentation of Limonene-contained Media and Orange Peel Hydrolyzate Int. J. Mol. Sci., 8(8), 777-787
2. Grohmann K., Baldwin E.A,(1992), Hydrolysis of Orange Peel with Pectinase and Cellulase Enzymes. Biotechnol. Lett.;14:1169–1174.Amr M. Bakry ,Shabbar Abbas ,Barkat Ali,Hamid Majeed,Mohamed Y. Abouelwafa,Ahmed MousaLi Liang, (2015) Microencapsulation of Oils: A Comprehensive Review of Benefits, Techniques, and Applications,Comprehensive reviews in food science and food safety , wiley online library.
3. Tripodo M.M., Lanuzza F., Micali G., Coppolino R., Nucita F,(2004)Citrus waste recovery: a new environmentally friendly procedure to obtain animal feed. Bioresour. Technol.;91:111–115.
4. James H. Clark , Lucie A. Pfaltzgraff, Vitaliy L. Budarin,Andrew J. Hunt, Mark Gronnow, Avtar S. Matharu, Duncan J. Macquarrie, and James R. Sherwood (2013), From waste to wealth using green chemistry, Abstracts of the 7th World Congress on Pediatric Critical Care IUPAC Pure Appl. Chem. , Vol. 85, No. 8, pp. 1625–1631.

5. **Vidya Sabale, P. M. Sabale and C. L Lakhotiya** (2007),In vitro studies on Rice bran wax as skin Moisturisers.Indian J Pharm Sci, 69 (2): 215-218.
6. G. Basarkar , G. Shirsath, S. Patil , (2013)Development of Microspheres containing diclofenac diethylamine as sustained release topical formulation , Bulletin of Pharmaceutical Research, 3,1,14-22 Rice bran wax Wikipedia free enclyopedia
7. B. Kamble, A. Kumar, K. Mahadik, A. Paradkar, (2010),Ibuprofenglyceryl Monostearate Beads Using Melt Solidification Technique: Effect Of Hlb International Journal of Pharmacy and Pharmaceutical Sciences , Vol 2, 4.