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List of Publications in Journals

1. **Rani, R.**, Gosh, T., & Badwaik, L. S. (2023). Optimization of mustard, soybean and flaxseed meal blend formulation for development of biopolymeric film and its characterization. *Sustainable Chemistry and Pharmacy*, *33*, 101147.
2. **Rani, R.**, & Badwaik, L. S. (2021). Functional properties of oilseed cakes and defatted meals of mustard, soybean and flaxseed. *Waste and Biomass Valorization*, 12, 5639–5647.
3. **Rani, R., & Badwaik, L. S. (2024).** Synergistic impact of natural gums and crosslinkers on the properties of oilseed meals based biopolymeric films. *International Journal of Biological Macromolecules*, 265, 130809.

List of publications under communication

1. Physico-chemical, functional, morphological and thermal properties of banana pseudo-stem, coconut coir and sugarcane bagasse fibres
2. Physical and Mechanical Behaviour of Plant Fibre-Reinforced Biocomposite film and Biodegradable Plates

Participation in National/International Conference

1. **Rani, R.**, & Badwaik, L. S., Effect of natural gums on the properties of oilseed meal based biopolymeric films: An approach towards waste utilization. Oral Presentation in the National Conference on Underutilized Food Resources: Nutrient Composition, Value Addition and Quality Assurance. 25th-26thMay, 2023. Mizoram University, Aizawl, Mizoram.
2. **Rani, R.**, & Badwaik, L. S., Study the effect of mustard, soybean and flaxseed meal blends on the properties of biopolymers. Oral Presentation in the International Conference on Sustainable Approaches in Food Engineering and Technology (SAFETy), 24th-25th June 2021, Tezpur University and University of Georgia, USA.
3. **Rani, R.**, & Badwaik, L. S., Characterization of the functional properties of oilseed meals for the development of bioplastics. Poster Presentation in the Indian Convention of Food Scientists and Technologists (ICFoST-2020), 30th January 2020-1st February 2020, Tezpur University, Tezpur, Assam.

Award

1. Recipient of **Shri Somalal Vyas-Sea Innovation Award-2024** for work entitled "Biodegradable Plates based on Oilseed Meals and Plant Fibres". **(Second Prize)**
2. Recipient of **Shri Somalal Vyas-Sea Innovation Award-2024** for work entitled "Fabrication of Biopolymeric Films using Gums". **(Second Prize)**

Waste and Biomass Valorization
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SHORT COMMUNICATION

Functional Properties of Oilseed Cakes and Defatted Meals of Mustard, Soybean and Flaxseed

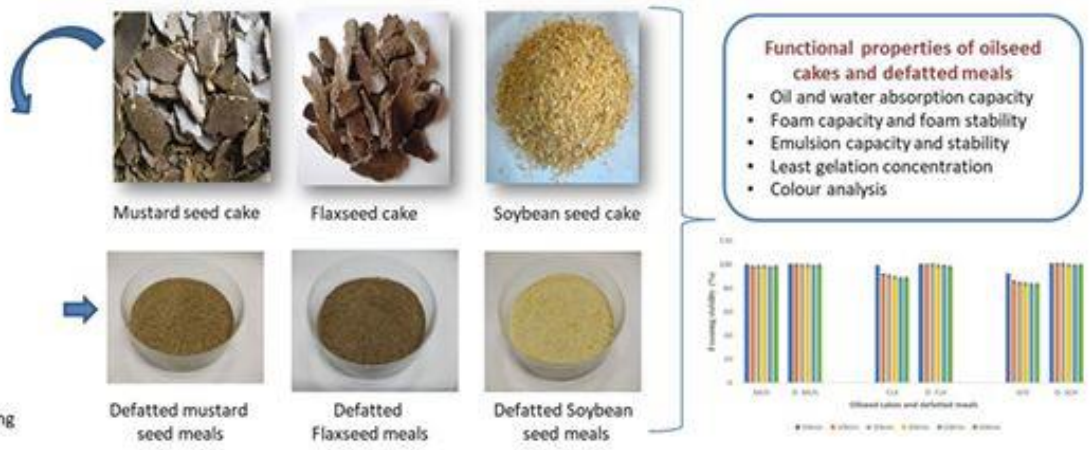
Ruchi Rani[1] · Laxmikant S. Badwaik[1]

Received: 28 October 2020 / Accepted: 19 February 2021

Abstract

Mustard and soybean seeds are most commonly known for their edible oilseeds whereas flaxseed, a non-edible oil category is known for its health benefits. The oilseeds cake have high content of fibre and protein, are usually seen as mass waste after the extraction of oils. The study was conducted to evaluate functional properties of oilseed cakes and meals. Water absorption capacity (WAC) and oil absorption capacity (OAC) was more in defatted seed meal compared to cake of mustard and soy seed meal. However, the results were revered in case of flaxseed meal. WAC was higher for defatted soyseed meal (24.67%) compared to defatted mustard and flaxseed meal. Among three cake samples OAC was higher in flaxseed cake (14.33%). Foaming capacity was higher for soybean seed cake (21.19%) followed by flaxseed cake (11.95%) and mustard seed cake (3.10%). Emulsion capacity was ranged from 40.69–51.38% and 47.26–57.18%; whereas, emulsion stability was ranged from 107.52–107.52% and 108.15–119.89% in seed cake and defatted seed meal respectively. Results indicated that the removal of fat from oilseed meal helps to increase their functional properties. This shows that oilseed meals are useful in food application, fortification and packaging instead of being leftover as waste.

Graphic Abstract



Keywords Oilseed cakes and meals · Functional properties · Foaming capacity · Emulsion capacity

✉ Laxmikant S. Badwaik
laxmikantbadwaik@gmail.com

[1] Department of Food Engineering and Technology, School of Engineering, Tezpur University, Napaam, Assam 784028, India

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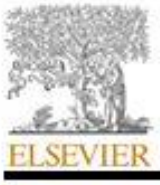

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Optimization of mustard, soybean and flaxseed meal blend formulation for development of biopolymeric film and its characterization

Ruchi Rani, Tabli Gosh, Laxmikant S. Badwaik *

Department of Food Engineering and Technology, School of Engineering, Tezpur University, Napaam, 784028, Assam, India

ARTICLE INFO

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Keywords:
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ABSTRACT

The current research work demonstrates the valorisation of oilseed meals by transforming them into biopolymeric films with tunable properties for stringent food packaging applications. The oilseed meals are obtained as waste materials after oil extraction having a large potential in the food industry. For the study, the biopolymeric films fabricated using defatted oilseed meals of mustard, flaxseed, and soybean each in range of (1–100%) using the mixture design. The films were developed using solvent casting method with the addition of a glycerol (75%) as plasticizer and soy lecithin (2%) as emulsifier. The effectiveness of the various proportions of the selected oilseed meals on water vapour permeability, water solubility, swelling property and tensile strength has been studied. The optimized films were obtained with the combination of 20.50% mustard seed meal, 67.15% flaxseed meal, and 12.33% soybean seed meal. The result obtained after investigation of selected responses were found as 32.09% solubility, 1.88 kPa tensile strength, elongation at break at 4.31%, and water vapour permeability with 0.68 g/Pa h m g. The thermal, morphological, and functional analysis results improved in the optimized biopolymeric films. The oilseed meals were found significant on the properties of the biopolymeric. The formulation obtained had improved mechanical as were as barrier properties of biopolymeric films.

1. Introduction

The utilization of waste material from available natural sources have been trending research in the field of food sectors (Abdel-shafy and Mansour, 2018). The importance of waste management has received a considerable attention all over the world for economic, social, and environmental wellbeing (Wilson et al., 2006). Since every industry produces a wide amount of dispose eventually after processing of food processing, therefore, attention is needed to treat the disposed materials to create "waste to wealth" (Ezejiofor et al., 2014). Additionally, the waste management is needed in parallel to the rest sectors of food industry for reducing the effect of waste on health and environment. The waste management includes various methods such as processing/extraction of wastes, incineration into biogas production, pre-treatment, hydrolysis, and anaerobic digestion into fertilizers as well as direct addition into food production (Abdel-shafy and Mansour, 2018). Utilization of waste or waste valorisation consist of the process of reusing, recycling, or composting waste materials where, the waste are more converted to new useful products and less heading to landfills contributing to environmental pollution (Roughan, 2021).

* Corresponding author.Department of Food Engineering Technology, Tezpur University, Napaam, Assam, 784028, India.
E-mail address: laxmikantbadwaik@gmail.com (L.S. Badwaik).

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Synergistic impact of natural gums and crosslinkers on the properties of oilseed meals based biopolymeric films

Ruchi Rani, Laxmikant S. Badwaik *

Department of Food Engineering and Technology, School of Engineering, Tezpur University, Napaam 784028, Assam, India

ARTICLE INFO

Keywords:
Oilseed cakes
acacia gum
Xanthan gum
Citric acid
Glutaraldehyde
Sustainability

ABSTRACT

The waste material utilization from available agricultural resources can be beneficial in the field of economic, social, and environmental well-being. One of the main industrial crops used to manufacture oil from oilseeds worldwide is agricultural waste, such as the cake made from oilseeds. In this study, de-oiled cakes are used to create biopolymeric films. Three widely accessible oilseed meals viz. flaxseed, soybean, and mustard were gathered, ground, and sieved. A film forming suspension of defatted meals along with natural gums (acacia and xanthan gum) and crosslinkers (citric acid and glutaraldehyde) were formed. The suspension was cast into petri dishes and dried to produce smooth and even films. The physical, functional, color, thermal and morphological properties of the oilseed meals-gums crosslinked biopolymeric film were evaluated and statistical analysis was performed. The solubility was found to be decreased and tensile strength was increased with the addition of citric acid and increase in tensile strength. There was significant difference observed in the values of elongation at break after addition of citric acid as crosslinker. The research shows how oilseed meals enriched with natural gum and crosslinkers may be converted into biopolymeric films, which can then be used in food packaging to lessen reliance on petroleum-based, non-biodegradable plastics.

1. Introduction

One of the most common materials that we come across in our daily life is the plastics. It has become a serious issue since it contributes into environmental pollution. To find an alternative to this problem, biopolymeric film production is the first thing that comes in our mind which can be renewed, found in abundance, should be eco-friendly as well as biodegradable through natural means and inexpensive in nature [1–3]. The development of a biodegradable packaging material out of waste can provide us an opportunity to replace non-biodegradable petroleum-based plastics. Proteins, lipids, starches or their blends have been found runners in the production of biopolymeric film and also can resolve the problem they're of being biodegradable, disposal and sustainability on earth [4].

One of the main industrial crops grown worldwide for the manufacture of oil is oilseed. Due to the presence of anti-nutritional chemicals, the main sources of oilseed meals (soybean, mustard, and flaxseed) after oil extraction are not recommended for human consumption. A legislative framework is necessary for these since, according to reports, 33 % of them are still disposed of in the open, even after being composted, incinerated, fermented, recycled into fertiliser, or even fed to cattle [5]. Proteins are abundant in defatted meals, therefore using them to create biopolymeric film material is an appealing substitute. The oilseed meals of neem seed, pumpkin seed, hempseed, Evening Primerose, Sunflower, Crambe seed, Carinata seed, Flaxseed, Soybean seed and sesame seed have been seen successfully used for developing packaging materials [6–11].

Effective formation of film using only oilseed meal is challenging task. During development of oilseed meals based biodegradable films, the oilseed meals particles in the suspension tend to settle down quickly which affect film formation. The possible solution is to use emulsifiers which can improve the emulsion stability of particles. The nature of compounds of hydrocolloids depends on its chemical structure. The hydrocolloids with highly branched structure tends to form gels more easily and are more stable in nature in comparison to linear structured hydrocolloids due to extended interaction along the chains is less possible [12]. The uses of natural gums in film formation have property to bind, stabilize, and suspend the agents and works excellent as emulsifiers and thickening agents. The most common gums which can be used are acacia gum and xanthan gum [13].

* Corresponding author at: Department of Food Engineering Technology, Tezpur University, Napaam, Assam 784028, India.
E-mail address: laxmikantbadwaik@gmail.com (L.S. Badwaik).

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Department of Food Technology

Mizoram University

(A Central University)
Tanhril, Aizawl, Mizoram – 796004, India

Certificate of Participation

This is to certify that

RUCHI RANI

from TEZPUR UNIVERSITY

has attended/presented a paper/poster during the

National Conference on Underutilized Food Resources: Nutrient Composition, Value Addition and Quality Assurance

organized by **Department of Food Technology**, Mizoram University, Mizoram, India
on 25th – 26th May, 2023

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on

Sustainable Approaches in Food Engineering and Technology

(SAFETy-2021)

24th-25th June, 2021

Certificate

RUCHI RANI

This is to certify that Dr./Mr./Ms. ..... has participated as Oral Presenter *..... at SAFETy-2021, organized by the Department of Food Engineering & Technology, Tezpur University, Assam, India, and Department of Food Science & Technology, University of Georgia, Georgia (US) in Association with AFST(I) Tezpur Chapter during 24th-25th June, 2021.*

Title: Study the effect of mustard, soybean and flaxseed meal blends on the properties of biopolymers

Author(s): Ruchi Rani & Laxmikant S. Badwaik

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Tezpur University, Tezpur, Assam

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"Biodegradable Plates based on Oilseed Meals and Plant Fibers"
And for Winning the Second Award with a Cash Prize of Rs.25,000 (As a team)

Presented at the SEA AGM and Awards Function
18th September 2024, Mumbai

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Tezpur University, Tezpur, Assam

This certificate is an appreciation for your significant contribution and successful innovative approach to
"Fabrication of Biopolymeric Films using oilseed Meals and Natural Gums"
And for Winning the Second Award with a Cash Prize of Rs.25,000 (As a team)

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Ajay Jhunjhunwala
President
The Solvent Extractors' Association of India

Haresh Vyas
Chairman
Royal Castor Foundation

Valorisation of oilseed meals for development of biopolymeric films and biodegradable plates using natural gums and plant fibres

by Ruchi Rani

Submission date: 13-Jun-2024 02:35PM (UTC+0530)
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