



P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2024; 12(1): 29-31

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Received: 08-12-2023

Accepted: 11-01-2024

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Oilcakes as a potential substrate for sustainable agriculture

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Abstract

In recent decades, a number of snowballing current issues e.g., over-exploitation and mismanagement of resources, the unsustainable consumption behaviours, the degradation of the environment and equilibrium of the ecosystems and climate change, were emerged. To mitigate these challenges, it is necessary to focus on new strategies and ways to make the best use of our natural resources and to eliminate the concept of wastes in supply chain. A new concept has been created where waste has been utilized by transforming into value-added products. Edible oil industries processed raw seeds to extract oil and leftover solid by-products known as oilseed cakes. Oilseed cakes and meals are the residues would act as valuable feeds for livestock as it is rich in protein. These agricultural residues serve as a major valuable feedstock for cattle and used for the production of value-added products such as biogas, biofuel, biopolymer, antibiotics, enzymes, etc.

Keywords: Protein, fertilizer, human, edible, non-edible, oilcakes, nutrition

Introduction

Oilseed cakes left after the oil extraction for different purposes are chiefly used as cattle feed, compost amendment, or plant conditioner. These oilseed cakes are rich in protein, nitrogenous compounds, and minerals. Besides its conventional usage, studies have been conducted to utilize these protein rich resources for human consumption. Considering the exponentially increasing human population and escalating food prices, these protein rich sources can be a novel food commodity and used to extract protein. The quality and functional properties of extracted oilseed cake proteins not only supplement the existing protein sources for the human consumption but also solve the problem of oilseed cakes disposal along with the additional income to the oilseed crop producers and processors. Production of proteins for human consumption from oil seed cakes may also reduce the carbon and water footprints while producing animal protein (Renu *et al.*, 2022) ^[10].

Types of oilcakes: There are two categories of oilcakes, i.e., edible and non-edible. Oilcakes have high nutritional value and can be used for the consumption of human as well as animals. They are used as processed ingredients (Hydro lysate, protein concentrate, isolate) or as substrate (In the production of amino acids, flavors, bioactive compounds, pigments, antibiotics, surfactants, enzymes, vitamins).

Edible oilcakes: The oilcakes that can safely fed to animal, such as groundnut oilcakes and coconut oilcakes, etc.



Source: velox 3dtech, Pune

Coconut oilcake

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Source: Assam edible oil ltd

Mustard Oilcake

Non-edible oilcakes: The oilcakes that is not suitable for feeding animals, such as castor oilcake, neem oilcakes, etc.



Source: Green Paradise

Castor Oilcake



Source: Rangamalai Organic Farms

Neem Oilcakes

Why they are non-edible?

The non-edible oilcakes contain a harmful toxic substance which makes them unsuitable for feeding.

Oilcakes	Toxic substance
Mahua oilcake	Mowrin
Castor oilcake	Ricin
Neem oilcake	Nimbia, Salamin
Jatropha oilcake	Jatropine

How oilcake is useful for plant?

- Nutrient-dense fertilizer:** Oilcakes are rich in NPK, all of which are essential plant nutrients. The use of oilcakes as a fertilizer can improve soil health and crop yield.
- Soil improvement:** By adding organic matter to the soil, oilcakes can improve soil structure, and fertility. This can aid in reducing soil erosion, increasing water retention, and encouraging healthy root growth.
- Pest control:** Natural compounds oilcakes can act as a repellent to pests, reducing the need for chemical pesticides.
- Nitrogen fixing bacteria:** Nitrogen fixing bacteria can be found in some oilcake, such as soybean oilcakes. These bacteria aid in the conversion of atmospheric nitrogen into a form that plants can use, thereby increasing soil nitrogen contents.
- Biofertilizers:** Organic fertilizer which is a good alternative to chemical fertilizer. Organic fertilizer convert nitrogen less soluble form is the main advantage in comparison to chemical fertilizer. Example cottonseed cake has all the nutrient fertilizer required for plant fertilizer.

Useful as animal feed

Oilcakes are rich in protein, carbohydrates, minerals, fibers etc. They are widely used as fodder in animal nutrition. Particularly black cumin seed cakes are rich in protein and some essential amino acids; they are important source for animal feed, increase egg production in chicken. Groundnut oilcakes improves the animal's overall body functioning. They are packed with carbohydrates, oils, fats, followed by protein (Girgih *et al.*, 2013) ^[13].

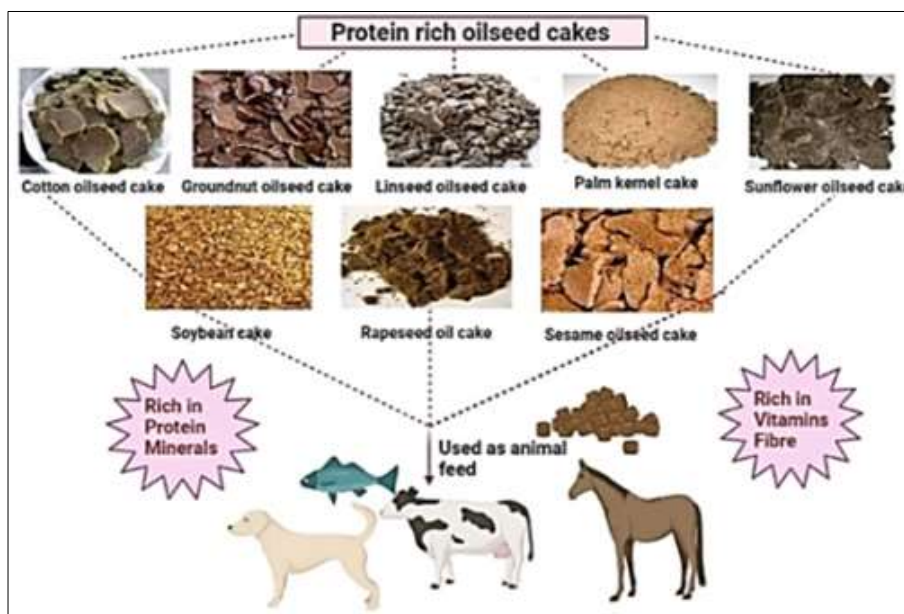


Fig 1: Figure shows various kinds of protein rich oilseed cakes used as animal feed.

Oilseed cakes as protein source

With increasing world population and the demand for food supply and especially protein rich products are increasing. However, the material cost, energy consumption, competition for land use, environmental pollution, soil deterioration, and climate changes associated with its proper losses are increasing which ultimately makes food harvesting to its processing create a lots of environmental problems beside problem associated with its proper disposal. Utilization this agro waste, including oilseed cakes is a sustainable method for producing alternative food sources which can be used to meet the increasing protein consumption by the growing population (Renu *et al.*, 2022) ^[10].

Oilseed cakes as edible products

In some countries, dehulled sunflower seed are available in the market in a roasted form and used for bakery and sweets items. Nutritional sunflower cakes use as recipes for human consumption. The dehulled oil cake powder was used in the recipes around 10 to 20%. The recipes like chapatti (A shallow fried item), bakery (A baked item), and pakodi (A deep-fried item) were prepared using oil cake powder and tested in the albino rats shows that the dehulled oilseed cake has more fat and protein whereas partially dehulled cake has more fibre content, fat, and protein.

Conclusion and Future Prospects

Oilseed cakes are rich in nutrient content such as fibre, protein, and energy as they give possible benefits when used as a by-product in the production of various organic chemicals, bioenergy, and biomolecule. The key point is that oilseed cakes are attractive due to their availability and relatively cheaper. The production of biogas and biodiesel are very important for economic development, and all the research indicates that the utilization of oil processing factory waste as biomass and generate beneficial products is helpful, efficient, and cost-effective. If the production of biodiesel and biogas is coupled with each other, the seed cakes provide very feasible commercial investment. Research shows that different waste to be used to produce bioenergy such as agricultural waste, wastewater sewage, etc. but the oilseed cake is one of the most attractive ways to produce biogas. And same in the term of cattle feed to be produced with oilseed cake is need to acquire depth knowledge. The cattle feed rate is increasing every year because insufficiency of farmlands to grow the feed. Thus, the cattle feed production from oilseed cakes concerns feasible and beneficial as well as it would reduce the environmental pollution and make it eco-friendly.

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