



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 IJCS 2019; 7(4): 3213-3216
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 Received: 07-05-2019
 Accepted: 09-06-2019

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Mustard oil cake water (Solution), its nutritional and microbial characteristics

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Abstract

A study on nutritional and microbial characteristics of Mustard oil cake water (solution) was carried out in the departments of soil science and plant pathology, UBKV, coochbehar-736165, West Bengal during February, 2019. Motive of this work was to characterize Mustard oil cake water according to its Physical properties, macro & micro nutrient Content and microbial population. It is recommended that it can be used as an alternative against chemical fertilizers and pesticides because it is rich in nutrient content and it has high population of bio-control agents.

Keywords: Mustard oil cake water or solution, liquid organic manure

Introduction

Organic farming is a holistic way of agriculture for conserving the soil physical and biological properties. It does not have any adverse effect on the ecosystem. Indian agriculture has a great opportunity to convert itself as organic agriculture because the per capita and per ha consumption of chemical fertilizers and pesticides in India is much lower than the global estimates. Popularization of organic farming can effectively prevent the entry of pesticides and toxicants in the food chain and prevent soil and water pollution (Sreenivasa *et al.*, 2009 and Natarajan, 2007) [12, 10]. Mustard oil cake water (solution) is a popular liquid organic manure and it is highly used in West Bengal and Bangladesh as a foliar spray for the development of crop plants (Hassan, 2017) [4]. Its significant nutrient content, beneficial microbial population load, growth promoters and bio-control agents. To popularize the use of Mustard oil cake water (solution), scientific validation of this manure is highly required. With this motive I decided to investigate nutritional and microbial characteristics of Mustard oil cake water (solution).

Materials and Methodology

Preparation of Mustard oil cake water (solution)

Ingredient: Mustard cake (3 Kg) and water (10 litres).

Procedure: Mix the mustard cake with water and keep it for fermentation for 3 -4 days. After that the mustard cake water should be sprayed to the crop field (Hassan, 2017) [4].



Mustard oil cake water (solution)

Nutritional and microbial analysis of Mustard oil cake water (solution)

The physical, nutritional and biological parameters of Mustard oil cake water (solution) were analysed on the day of preparation (0 days), 20 days after preparation and 40 days after preparation using scientifically approved standard procedures. The standard procedures performed for the estimations of these parameters are described in Table-1 and Table-2.

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Table 1: Physical and chemical properties of Mustard oil cake water (solution)

Sl. No.	Parameters	Methods	Reference
1	Colour	Visual evaluation	
2	Odour	Sensory evaluation	
3	Mould Growth	Visual evaluation	
4	Maggot Population	Visual evaluation	
5	pH	pH meter method	Jackson (1973) ^[5]
6	EC	Conductivity meter method	Jackson (1973) ^[5]
7	Organic Carbon (OC)	Walkley and Black wet digestion	Walkley and Black (1934) ^[16]
8	Total Nitrogen	Microkjeldhal method	Jackson (1973) ^[5]
9	Total Phosphorus	Nitric-Perchloric(9:4) digestion and colorimetry using vanado-molybdo phosphoric yellow colour method	Jackson (1973) ^[5]
10	Total Potassium	Nitric-perchloric(9:4) digestion and flame photometry	Jackson (1973) ^[5]
11	Total Calcium	Nitric-perchloric(9:4) digestion and AAS	Jackson (1973) ^[5]
12	Total Magnesium	Nitric-perchloric(9:4) digestion and AAS	Jackson (1973) ^[5]
13	Total Sulphur	Nitric-perchloric(9:4) digestion and Turbidimetry	Massoumi and Cornfield (1963) ^[9]
14	Total Micronutrients Fe, Mn, Zn, Cu	Nitric-perchloric(9:4) digestion and AAS	Jackson (1973) ^[5]

Table 2: Biological properties of Mustard oil cake water (solution)

Sl. No.	Parameters	Methods	Reference
1	Fungi	Martin's rose Bengal Agar	Martin (1950) ^[8]
2	<i>Actinomyces</i>	Ken knight's Agar medium	Cappuccino and Sheman (1996) ^[1]
3	PSB	Pikovskaya's medium	Sundararao (1963)
4	<i>Azospirillum</i>	Nitrogen free Bromothymol blue medium	Dobereiner <i>et al.</i> , (1976) ^[2]
5	<i>Azotobacter</i>	Jensen's medium	Jensen (1942) ^[6]
6	<i>Trichoderma</i>	<i>Trichoderma</i> specific Medium	Saha and Pan (1997) ^[11]
7	<i>Pseudomonas</i>	King's B Agar medium	King <i>et al.</i> , (1954) ^[7]
8	<i>Rhizobium</i>	Yeast extract Mannitol Agar with Congo red	Fred <i>et al.</i> , (1932) ^[3]

Results and Discussion

Physical and physicochemical parameters of Mustard oil cake water (solution) were mentioned in Table-3.

Mustard oil cake water			
Parameters	On the day of preparation (0 days)	20 days after preparation	40 days after preparation
Colour	Yellow	Dark yellow	Dark yellow
Odour	Foul odour	Foul odour	Extreme foul odour
Mould growth	No mould growth	Heavy mould growth	No mould growth
Maggot Population	No maggot growth	No maggot growth	No maggot growth
pH	8.73	8.84	9.05
EC (dS/m)	5.71	7.73	8.52

The colour of freshly prepared Mustard oil cake water was dark yellow and it became darker from the 20 days onwards. As the storage period progressed, the preparation became darker in colour without much significant change. Soaking of mustard cake in water induced the endogenous 'Myrosinase' enzyme and that react with glucosinolate resulting in substantial hydrolysis of glucosinolate to volatile metabolites viz. isothiocyanate, CNS, nitriles and other degradation products. For those activities colour of the solution became dark yellow with time (Tyagi *et al.*, 1997) ^[15].

Fresh preparation of Mustard oil cake water possessed a foul smell. The change in odour was noticed from 10 days onwards and progressed up to the end of storage. When mustard cake was soaked with water, the glucosinolate of mustard cake is hydrolysed. Gluconapin was the major glucosinolate in mustard cake, while sinigrin and pentenyl were in minor quantities. Gluconapin degraded linearly with time and rate of degradation is increased due to presence of water. Butenyl isothiocyanate was the major degradation product which increased linearly with time whereas allyl isothiocyanate was detected only in minor concentrations. For these activities, a foul is released from mustard oil cake water (Tyagi, 2002) ^[14].

There was no mould growth in fresh preparation of Mustard oil cake water whereas it was first observed 7 days after

preparation. Mould growth was observed both on the surface and also on the sides of the storage vessel from 15 days onwards, the decrease in mould growth was observed in 25 days and was completely absent in 40 days. Higher quantity of un-decomposed solid portion in Mustard oil cake water might be the reason.

No maggots were observed in Mustard oil cake water during the entire period of storage.

The highest nitrogen content was recorded 20 days after preparation in Mustard oil cake water (8358 ppm) while on the day of preparation it recorded the lowest value (1540 ppm).

The highest phosphorus content was recorded 20 days after preparation in Mustard cake water (284.499 ppm) while on the day of preparation it recorded the lowest value (68.898 ppm).

The highest Pottasium content was recorded 40 days after preparation in mustard oil cake water (1741.043 ppm) while on the day of preparation it recorded the lowest value (503.498 ppm).

The highest Ca, Mg, Fe, Zn, Cu and Mn content was recorded 40 days after preparation in mustard oil cake water (107.82, 22.23, 11.57, 0.764, 2.23, 0.184 ppm) while on the day of preparation it recorded the lowest value (48.42, 5.15, 4.47, 0.032, 0.874, 0.068 ppm).

The highest S content was recorded 20 days after preparation in Mustard cake water (496.13 ppm) while on the day of preparation it recorded the lowest value (271.48 ppm)

The macro and micro nutrient content of Mustard oil cake water (solution) was mentioned in Table-4.

Table 4: Macro and micro nutrient content of Mustard oil cake water

Mustard oil cake water (solution)			
Parameters	On the day of preparation (0 days)	20 days after preparation	40 days after preparation
N mg/dm ³	1540.95	8358.28	7358.42
P mg/dm ³	68.898	284.449	195.886
K mg/dm ³	503.498	1147.445	1741.043
Ca (mg/l)	48.42	58.28	107.82
Mg (mg/l)	5.15	16.78	22.23
S (mg/l)	271.48	496.13	364.25
Fe (mg/l)	4.47	6.59	11.57
Zn (mg/l)	0.032	0.246	0.764
Cu (mg/l)	0.874	1.12	2.23
Mn (mg/l)	0.068	0.112	0.184

The highest fungi population was noticed 40 days after preparation in Mustard oil cake water (2×10^3 cfu/ml) while on the day of preparation it recorded the lowest value (18×10^3 cfu/ml).

The highest Actinomycetes population was noticed 40 days after preparation in Mustard oil cake water (6×10^5 cfu/ml) while on the day of preparation it recorded the lowest value (3×10^2).

The highest Pseudomonus population was noticed 40 days after preparation in Mustard oil cake water (17×10^4 cfu/ml) while on the day of preparation it recorded the lowest value (2×10^3 cfu/ml).

The highest PSB population was noticed 40 days after preparation in Mustard oil cake water (3×10^3 cfu/ml) while on the day of preparation it recorded the lowest value (19×10^5 cfu/ml).

The highest Azotobacter population was noticed 40 days after

preparation in Mustard oil cake water (13×10^6 cfu/ml) while on the day of preparation it recorded the lowest value (5×10^3 cfu/ml).

The highest Azospirillum population was noticed 40 days after preparation in Mustard oil cake water (7×10^4 cfu/ml) while on the day of preparation it recorded the lowest value (2×10^2 cfu/ml).

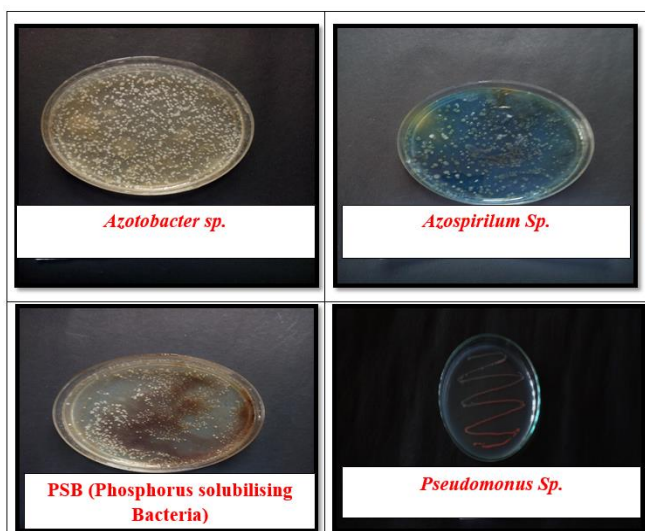
The highest Rhizobium population was noticed 40 days after preparation in Mustard oil cake water (6×10^4 cfu/ml) while on the day of preparation it recorded the lowest value (1×10^2 cfu/ml).

The highest *Trichoderma* population was noticed 40 days after preparation in Mustard oil cake water (18×10^5 cfu/ml) while on the day of preparation it recorded the lowest value (3×10^3 cfu/ml).

Microbial population of Mustard oil cake Water (solution) was mentioned in Table-5.

Table 5: Microbial population Mustard oil cake water (solution)

Mustard oil cake water (solution)			
Parameters	On the day of preparation (0 days)	20 days after preparation	40 days after preparation
Fungi (cfu/ml)	4×10^3	14×10^3	19×10^3
Actinomycetes(cfu/ml)	0	3×10^3	6×10^5
Pseudomonus (cfu/ml)	3×10^3	7×10^4	17×10^4
PSB(cfu/ml)	3×10^3	12×10^5	19×10^5
Azotobacter (cfu/ml)	5×10^3	16×10^5	13×10^6
Azospirillum (cfu/ml)	2×10^2	4×10^3	7×10^4
Rhizobium (cfu/ml)	1×10^2	3×10^3	6×10^4
Trichoderma (cfu/ml)	3×10^3	11×10^5	18×10^5



Conclusion

The studies concluded that mustard oil cake water had high nutrient content and beneficial microbial population. Nutrient content of this solution was highly influenced by its microbial population. Fungi helped to breakdown complex organic compounds and produce simple organic and inorganic compounds which were useful for plants. Azotobacter, Azospirillum and Rhizobium helped to fix more N in crop field. PSB enhance the P solubilisation in crop field. Actinomycetes help to decompose complex organic molecules and Pseudomonus showed antagonistic potential, while *Trichoderma* will help to protect the crop from soil-borne diseases. Spraying of this solution on the day of preparation may not be recommended because the microbial population and nutrient content were the minimum and most of the organic matter were not properly decomposed. So foliar and soil application of Mustard oil cake water from 20 days of its

preparation to 40 days of its preparation may be recommended for the crop and soil because we can utilise its total potential.

Acknowledgement

My special thanks to Saddam da, Salim da, Amar da and my classmate Hiralal Mandi for their cooperation during laboratory work.

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