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Evaluation of Mushroom spent compost Based on Fourier transform infrared spectroscopy (FTIR) analysis

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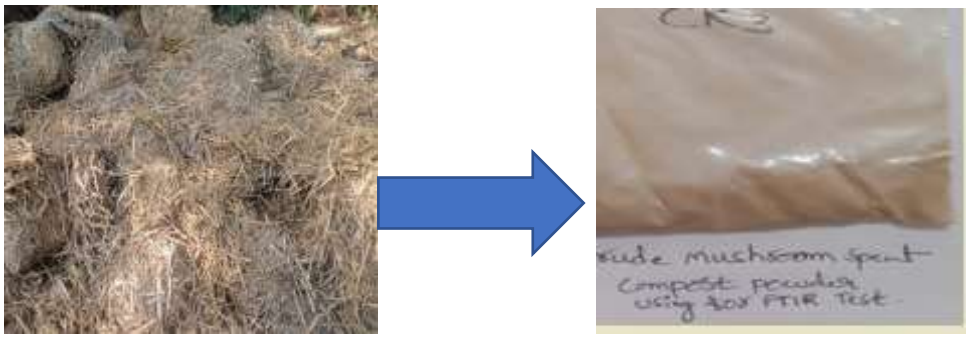
Abstract: The study purposes a new,simple approach based on FTIR analysis ,followed by Characterization and Identify the functional groups contained in the spent mushroom compost (SMC) .The main organic compounds and functional groups found on the surface of agricultural wastes ,such as SMS ,make waste biomass a good value added. The FTIR Spectroscopic studies revealed different characteristic peak values with various functional compounds in the extracts of SMC confirmed the presence of Secondary amine alkane, alkene, carboxylic acid, sulfone, tertiary alcohol, primary alcohol, isothiocyanate, allene compounds, which showed major peaks. The FTIR method was performed on a spectrophotometer, which was used to detect the characteristics peak values and their functional groups. The results of the present study generated the FTIR spectrum profile of SMC can be used against Root knot nematodes in organic management practices

Keywords: Spent mushroom compost, FTIR, Functional groups.

Introduction: Spent mushroom compost can be utilized in agriculture since it improves soil quality, absorbs pollutants besides being a great carrier for microbes having plant growth-promoting properties, and shows biological efficiency and effectiveness against many soil-borne plant pathogens (Othman et al., 2020). Spent mushroom compost (SMC) is the residual by product produced by the mushroom industry. It remains, however, a good source of general nutrients (0.7% N, 0.3% P, 0.3% K plus a full range of trace elements), as well as a useful soil conditioner (Bradley, 2004). The phenolic compounds present in SMC have antimicrobial activity, which could be an effective biocontrol of Root knot nematodes (RKN). The characteristics of the compost are mainly derived from the raw mushroom residue, which contains carbohydrates, nitrogen compounds that include crude protein and decomposition products and aliphatic compounds that are mainly crude fat. These compounds are mainly decomposed to carbon dioxide, ammonium ion, amide nitrogen, nitrate ion, protein and its decomposition products. The FTIR spectrum of raw mushroom waste showed peaks corresponding to different functional groups, including carbohydrates such as cellulose, hemicellulose and lignin, proteins, silicate minerals and amide compounds. Fourier-transform infrared spectroscopy (FT-IR) is one of the most widely used methods to identify chemical compounds and elucidate chemical structure, displaying, as main its advantages, rapid, reagent-less, and high-throughput operation within a wide range of matrices .It allows rapid and simultaneous characterization of different functional groups, such as lipids, proteins, and polysaccharides .

Material and Methods :

Sample collection: Spent mushroom compost sample collected during March, 2024 from mushroom cultivation unit of Krushi Defence Colony, Patancheru, Hyderabad.



Sample preparation:

The Spent mushroom compost sample were sterilized using an autoclave at 121℃ for 15 min and stored in a dry condition. This media (SMC) will be used as raw material. 500gms of SMS were taken and grinded as a fine powder.Furthermore, the material will be characterized.

Fourier-Transform Infrared (FTIR)

FTIR is a tool used to analyze functional groups in a chemical compound qualitatively. The characterization was carried out on Spent mushroom compost (SMC) biomass sample. FTIR analysis to understand the phytochemical functional group of the current Spent mushroom compost (SMC)

Results and discussion

Fourier-Transform Infrared (FTIR) analysis:

In the present study ,to confirm the pesence of phytochemicals in the spent mushroom compost ,FTIR was performed ,It is a quantitative tool,to measure the banding mechanisms and also symmetry of the molecules.

FTIR analysis Spent mushroom compost showed 8 Important Peaks the scan was plotted between wave number Cm^{-1} ranges 4000-750. The Eight prominent vibrations were observed ,as strong absorption band were noticed .A band at 792.74cm^{-1} represents C-H bending, 1078 cm^{-1} represents primary alcohol C-O stetching, 1099.43cm^{-1} represents tertiary alcohol C-O stretching,1321.24 cm^{-1} prepresents Sulfone S=O stretching ,1433.11cm^{-1} represents carboxylic acid O-H bending ,1653.00 cm^{-1} represents alkene C=C stetching ,2920.23cm^{-1} represents alkene C-H stetching and 3305.99cm^{-1} represents secondary amine N-H stretching, Fig,1.

The ranges of wave number Cm^{-1} (4000-750) and percentage of Transmittance (50-!00%) on X-axis and Y-axis ,respectivelywere usedto plot the FTIR spectrum of Spent Mushroom compost

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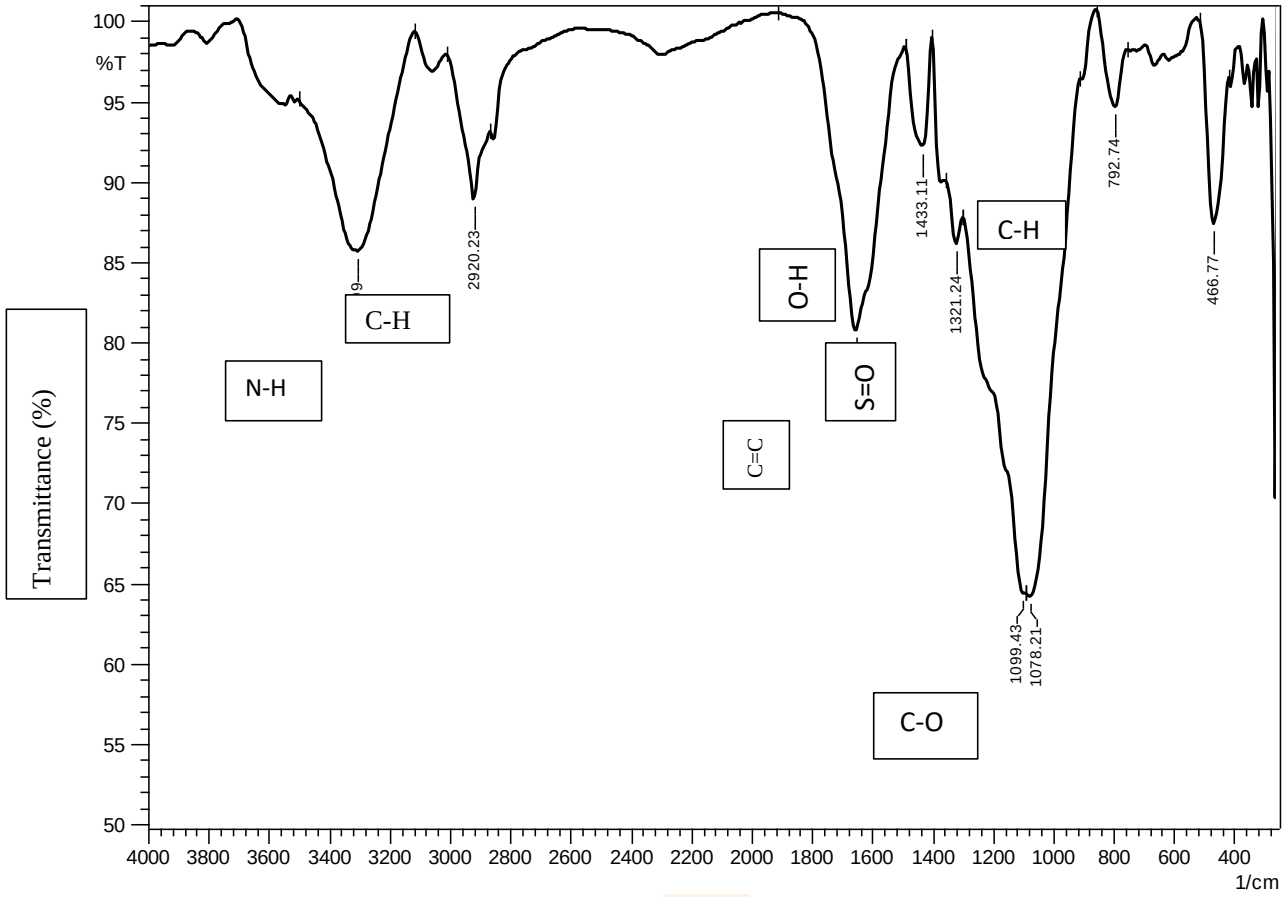
FTIR analysis Report



Wave Number (Cm^{-1})

Fig.1. FTIR- Scan Spectrum Spent Mushroom compost (SMC)

Table 1: Report on FTIR analysis of Spent Mushroom compost (SMC)

S. No	Peak position or Wave Number (cm^{-1})	Group	Class	Peak details
1	3305.99	N-H stretching	Secondary amine	Medium
2	2920.23	C-H stretching	Alkene	Medium
3	1653.00	C=C stretching	Alkene	Medium
4	1433.11	O-H bending	Carboxylic acid	Medium
5	1321.24	S=O stretching	Sulfone	Strong
6	1099.43	C-O stretching	Tertiary alcohol	strong
7	1078.21	C-O stretching	Primary alcohol	Strong
8	792.74	C-H bending	1,4 di substituted 1,2,3,4 tetra substituted	Strong

Conclusion :

The Results of the Characterization of raw material of spent mushroom compost, which meet the highest peak values, such as having N-H, C-H and S=O Functional groups that function as characterization of different functional groups, such as lipids, proteins, and polysaccharides.

Spent mushroom compost can be used as an effective tool to manage root-knot nematodes and save the environment from the effect of nematodes. Further research work is needed to investigate the effect of spent mushroom compost on the management of root knot nematodes and other soil born diseases. How spent mushroom compost can help in improving the soil health, also needs an intensive research.

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