Theme 3
Impacts of soil nutrient management on the environment and climate change

NITROGEN RELEASE MECHANISMS OF LIGNITE-BASED NITROGEN FERTILIZER IN CALCAREOUS SOILS

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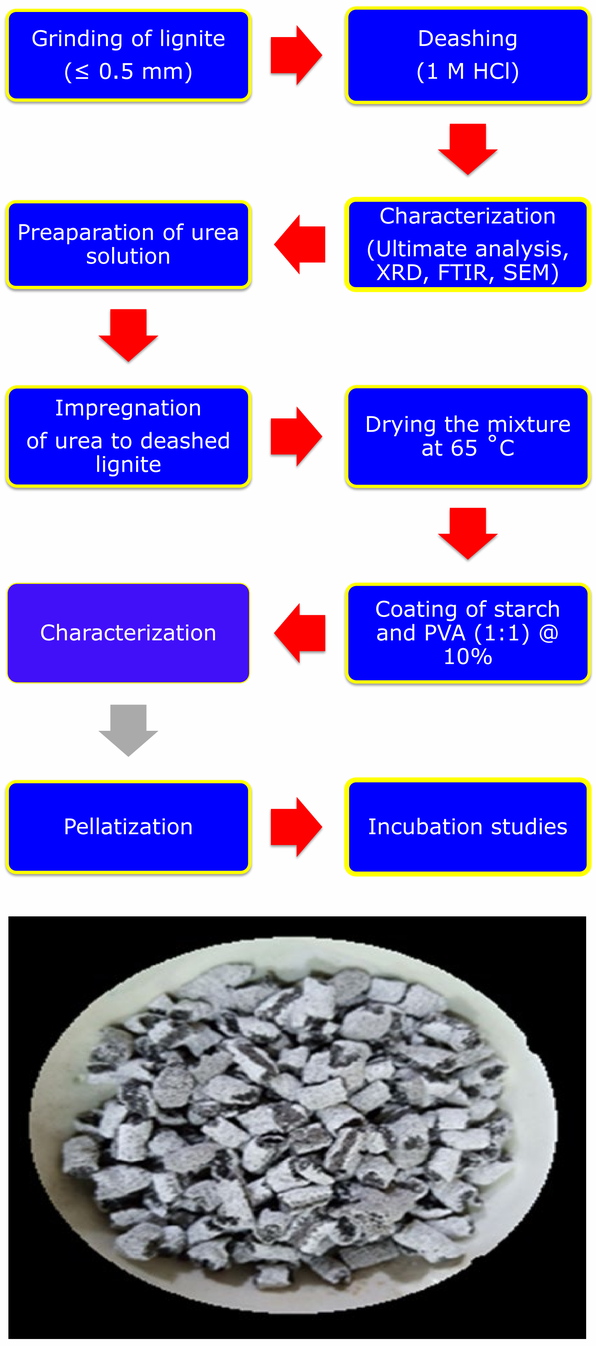
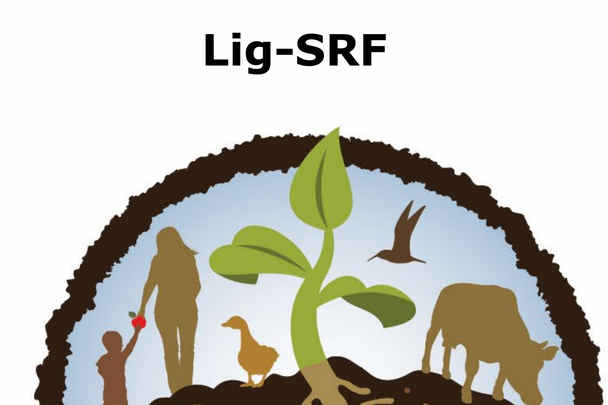
INTRODUCTION

Lignite is an abundant carbon-based material available across the word. As an efficient soil amendment and commercial adsorbent, it has proven benefits. Considering the challenge of finding a suitable carrier for synthesis of slow-release fertilizers (SRFs), lignite could be potential candidate having extensive surface area, ion-exchange capacity, porosity, and variety of surface functional groups. In this study the characteristics of lignite were explored by XRD, FTIR, and SEM and a novel Lignite based N SRF (Lig-SRF) was synthesized and evaluated in various incubation studies to test N release pattern, NH3-volatization, NO3-leaching, and N2O emission in different soils.

METHODOLOGY





Lig-SRF

RESULTS

Parameter		Raw Lignite	Deashed Lignite
Chemical	pH	3.84 ± 0.04	3.70 ± 0.04
	EC (d Sm^{-1})	0.79 ± 0.01	0.54 ± 0.01
	CEC ($cmol^{+}kg^{-1}$)	71.77 ± 0.24	80.10 ± 0.28
Proximate	Volatile matter (%)	49.37± 0.63	44.37 ± 0.92
	Ash (%)	2.14 ± 0.04	1.27 ± 0.03
	Fixed carbon (%)	48.49 ± 0.96	54.24 ± 1.07
Structural	Surface area (m^2 g^{-1})	2.44 ± 0.04	13.11 ± 0.21
	Pore volume (cm^3 g^{-1})	0.019 ± 0.00	1.33 ± 0.009

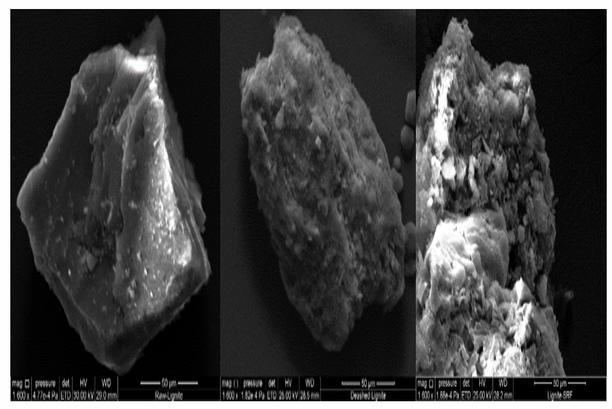


Fig 1: (A) Raw lignite, (B) Deashed lignite, (3) Urea impregnated lignite

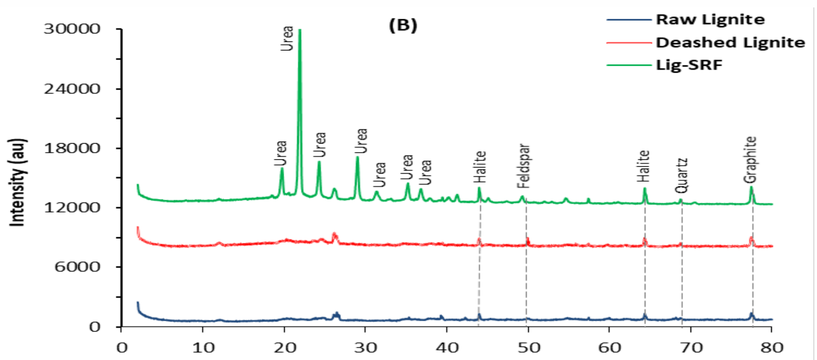


Fig. 2. Crystalline structure stability of raw lignite, deashed lignite, and urea impregnated lignite by X-Ray Diffraction (XRD)

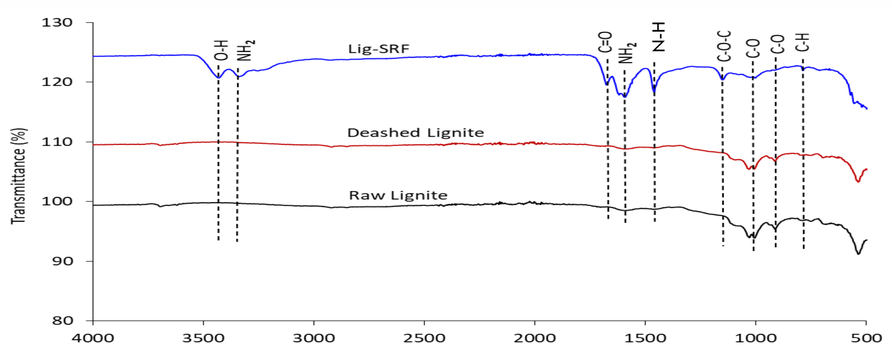


Fig 3. Surface functional groups of raw lignite, deashed lignite, and urea impregnated lignite by (FTIR)

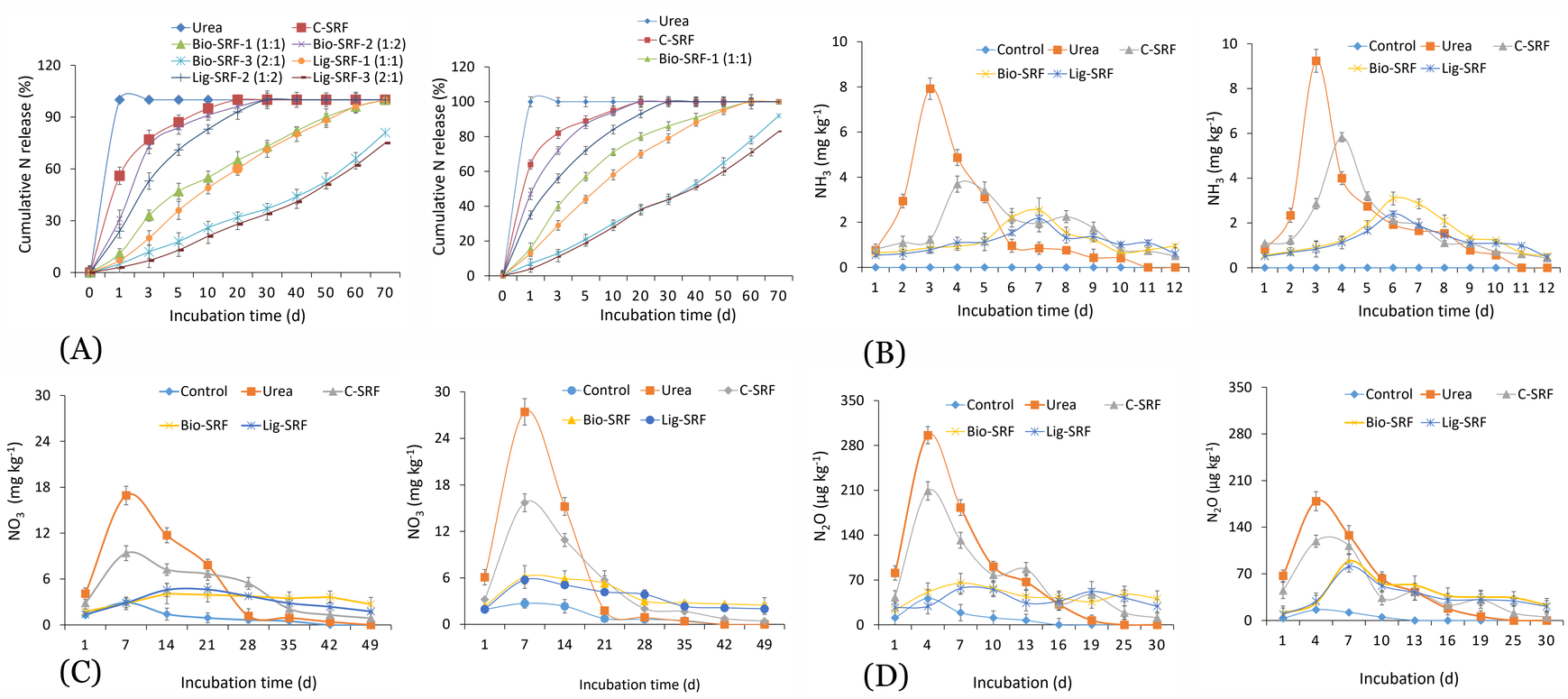


Fig. 3. Impact of N fertilizers on (A) N release, (B) NH3-volatilization, (C) NO3-leaching, (D) N2O emission in fine & coarse texture soils

CONCLUSIONS

The research findings showed that had properties to synthesize excellent new SRFs. Lig-SRF significantly decreased the N mineralization in soils. The delayed N hydrolysis resulted the decreased NH3-volatilization, NO3-leaching, and N2O-emission in different soils.

REFERENCES

1. Rashid, M., Hussain, Q., Khan, K.S. *et al.* 2021. Carbon-Based Slow-Release Fertilizers for Efficient Nutrient Management: Synthesis, Applications, and Future Research Needs. *J Soil Sci Plant Nutr* **21,** 1144–1169.

2. Rasse, D.P., Weldon, S., Joner, E.J. et al. 2022. Enhancing plant N uptake with biochar-based fertilizers: limitation of sorption and prospects. Plant Soil 475, 213–236.