

Method for Accumulation of Silver by Rice and Possible Metal Extraction by Agriculture

IITM Technology Available for Licensing

Problem Statement

- Generally, concentration of silver in soil does not exceed 0.1 mg/kg & in agriculture crops it is <1mg/kg of dry weight.
- Enhanced accumulation of arsenic & other heavy metals have seen in several rice varieties. Further, a few conventional method for manufacturing/extraction of a plurality of gold nanoparticles in a plant discussed herein.
- However, accumulation & extraction of metals from rice to a greater extent is not discussed so far.
- Present Patent discussed **rice variety** which accumulates **silver to the extent of 15 mg/kg** making it a viable method for extractive metallurgy.

Technology Category/ Market

Technology: Accumulation of Silver by Rice & Possible Metal Extraction by Agriculture

Industry: Food Industry (Cereals);

Applications: Extraction of silver/metal in Agriculture applications; Bio-amplification

Market: The global precious metals recovery market is projected to reach USD **18.7B** by 2030, growing at a **CAGR of 7%** from 2022 to **2030**.

Technology

- Present patent claimed a **process of accumulation and extraction of noble metal, silver** from soil in Garib-sal rice variety.
- Said method comprises the steps of:
 - **Growing Garib-sal rice variety** in a soil rich in heavy metals;
 - **Extracting the metal from the bran of Garib-sal rice variety by burning the hay and husk, & then processing the residue to obtain the metal.**
 - The silver is accumulated in the **aleuronic layer of the rice grain** & the variety showed

enhanced silver accumulation upto 15.61 mg/kg in its grain grown in the soil with Ag concentration of approximately 0.15 mg/kg.

Images

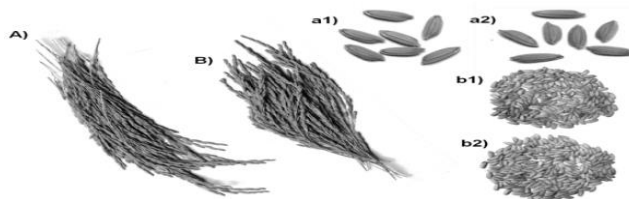


Fig.1: Depicts Photograph of the G2 rice grown in the lab in A) normal soil; B) silver supplemented soil;

Key Features / Value Proposition

Technical Perspective: 1.The process facilitates said silver **decreases** subcutaneously in **sub aleurone** & **negligible** in the **endosperm** of the **rice grain**, results of **~100 times** bio-amplification.

2.The **accumulation of silver** in the aleuronic layer of the rice grain is **identified** using **nano SIMS**.

Industrial Perspective: The **silver** is **extracted** from the **bran after milling** of the rice, thereby causing **no loss of the foodstuff**, wherein said metal comprises silver, gold, platinum, iron, manganese, chromium, copper, palladium, tin, zinc, cobalt and nickel.

Intellectual Property

IITM IDF Ref. 1268;

Patent No: 365675 (Granted)

TRL (Technology Readiness Level)

TRL-3/4, Proof of Concept ready validated

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Images (Experimental Images)

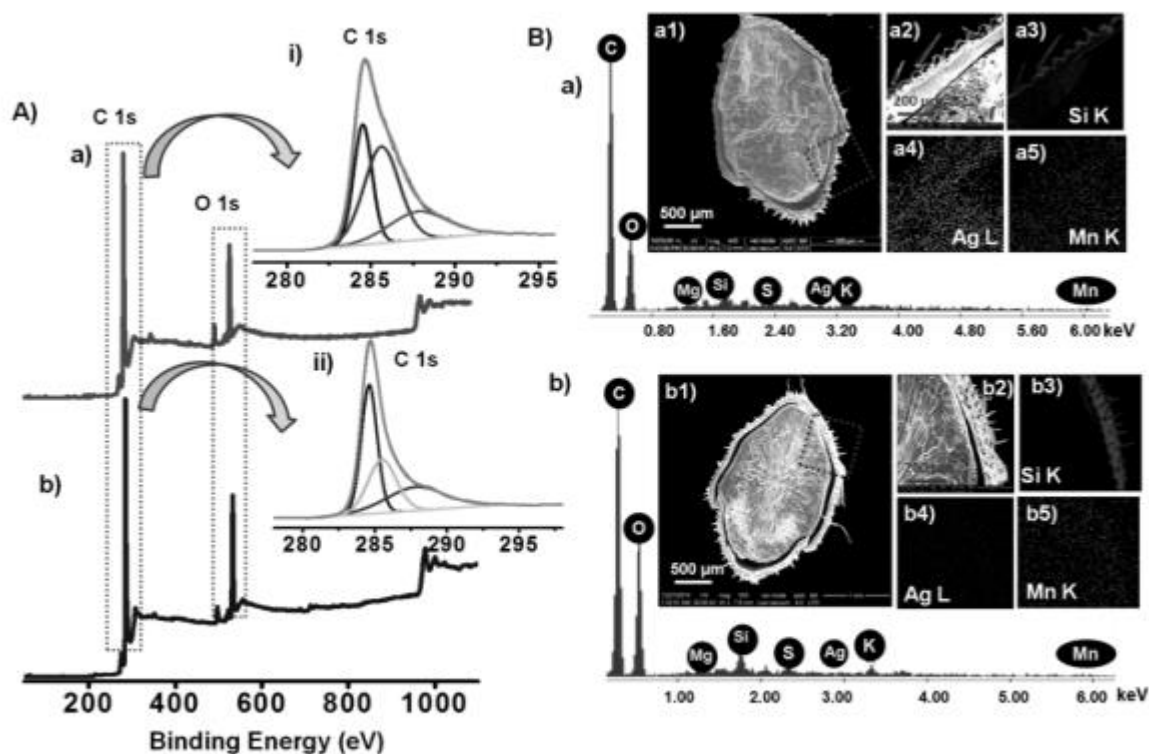


FIGURE 2

Fig.2: Depicts XPS of the G2 variety rice grown in A) silver supplemented and B) normal soil, C1s of the same is expanded in the inset, marked as i and ii. SEM/EDS spectrum of a horizontally cut husked rice grain cultivated in C) silver supplemented and D) normal soil. Corresponding SEM image is shown in a1 and a2, the elemental map is taken from a small portion marked as b1 and b2 in the inset, also marked in dotted lines in figure. The SEM image of the corresponding area is shown in c1 and c2, respectively. Elemental mapping of Si K, Ag L and Mn K are represented in d1 and d2, e1 and e2 and f1 and f2, respectively.

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