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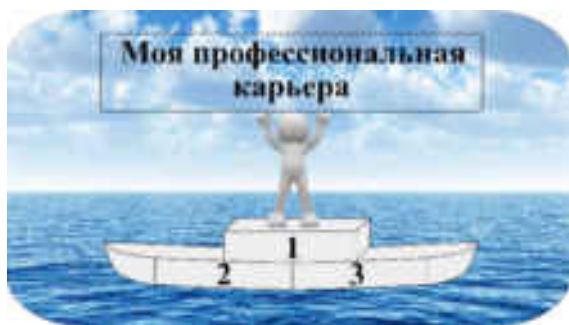


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**Международный научно-образовательный электронный журнал
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Журнал объединяет авторов на территории стран СНГ и помогает обмениваться передовыми научно-образовательными исследованиями.

Содержит научные статьи отечественных и зарубежных авторов по экономическим, техническим, философским, юридическим и другим наукам.

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Abstract

Activated carbon is a highly porous material widely used for adsorption of pollutants, water purification, air filtration, and energy storage. Rice husk, an abundant agricultural by-product, offers a sustainable and low-cost precursor for producing activated carbon. Pyrolysis, a thermal decomposition process in an inert atmosphere, is an effective method to convert rice husk into activated carbon with high surface area and porosity. This article presents the technology of obtaining activated carbon from rice husk via pyrolysis, including pre-treatment, pyrolysis parameters, activation methods, and applications.

1. Introduction

Activated carbon is a versatile material known for its high adsorption capacity, chemical stability, and large surface area. Agricultural residues, including rice husk, coconut shell, and sawdust, are commonly used as precursors due to their high carbon content and renewability.

Rice husk is particularly advantageous because:

- It is abundant in rice-producing regions
- Contains 20–25% silica, which can enhance adsorption properties
- Reduces agricultural waste and promotes sustainable resource utilization

Pyrolysis converts organic matter into carbon-rich material by heating under controlled conditions in the absence of oxygen. Subsequent activation increases

porosity and surface area, making the material suitable for adsorption and catalytic applications.

2. Pre-Treatment of Rice Husk

2.1 Cleaning

- Removal of dirt, dust, and other impurities by washing with water
- Drying at 80–110°C to remove moisture

2.2 Size Reduction

- Milling or grinding to reduce particle size to 1–5 mm
- Ensures uniform heating and better pyrolysis efficiency

2.3 Chemical Pre-Treatment (Optional)

- Impregnation with acids (H_3PO_4 , HCl) or bases (KOH , NaOH)
- Enhances pore development and increases surface area
- Typical ratio: 1:1 to 1:3 (chemical: rice husk by weight)

3. Pyrolysis Process

3.1 Reactor Type

- Fixed-bed or rotary kiln reactors are commonly used for laboratory and pilot-scale production
- Temperature-controlled heating ensures uniform carbonization

3.2 Pyrolysis Parameters

- Temperature range: 400–800°C
- Heating rate: 5–15°C/min
- Residence time: 30–120 minutes
- Inert atmosphere: nitrogen or argon gas to prevent combustion

3.3 Mechanism

- Thermal decomposition of cellulose, hemicellulose, and lignin in rice husk
- Volatile compounds are released, leaving carbon-rich char
- Silica content remains as ash, contributing to mechanical strength

4. Activation of Carbon

4.1 Physical Activation

- Treatment of char with steam or CO₂ at 700–900°C
- Creates micro- and mesopores
- Increases surface area and adsorption capacity

4.2 Chemical Activation

- Impregnated chemicals (KOH, H₃PO₄, ZnCl₂) react during pyrolysis
 - Produces highly porous activated carbon at lower temperatures than physical activation
 - Enhances pore structure and functional groups for adsorption
-

5. Properties of Rice Husk Activated Carbon

- **Surface area:** 500–1500 m²/g depending on activation method
 - **Pore volume:** 0.4–1.0 cm³/g
 - **Moisture content:** <10%
 - **pH:** 6–9 (aqueous slurry)
 - **Adsorption capabilities:** Effective for dyes, heavy metals, organic pollutants
-

6. Applications

- **Water treatment:** Removal of dyes, heavy metals, and organic pollutants
 - **Air purification:** Adsorption of volatile organic compounds and odors
 - **Energy storage:** Electrode material in supercapacitors and batteries
 - **Catalysis support:** Carrier for metal catalysts in chemical reactions
 - **Agricultural use:** Soil amendment and pollutant adsorbent
-

7. Environmental and Economic Considerations

- Utilizes agricultural waste, reducing disposal problems
- Provides a low-cost raw material for activated carbon production
- Reduces dependence on non-renewable resources

- Energy consumption can be optimized by using by-product gases from pyrolysis
-

8. Conclusion

Rice husk is a sustainable and abundant precursor for activated carbon production. Pyrolysis followed by physical or chemical activation enables the production of highly porous and high-surface-area carbon suitable for environmental, energy, and industrial applications. Optimizing pre-treatment, pyrolysis parameters, and activation techniques ensures efficient production of high-quality activated carbon while minimizing environmental impact.

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