Synthesis of rice straw derived activated carbon for capturing carbon dioxide

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1. Introduction

Issues!!

- **Rice straw** is the vegetative part of the rice plant
- It may be **burned** and left on the field before the next ploughing
- In developing countries, over 90% of rice straw are **openly burned**
- These practices create severe **health and safety problems, degrade soil fertility, and environmental consequences**.
- The openly burned waste **discharges CO_2** in the air, which is the primary source of greenhouse gas, and responsible for **global warming**
- Rice straw is another source of CO_2 emission in developing countries
- Millions of tons of rice straws (RS) are burnt annually in South Asian countries through wildfires, post-harvest burning of cultivation fields, and domestic uses for cooking and heating

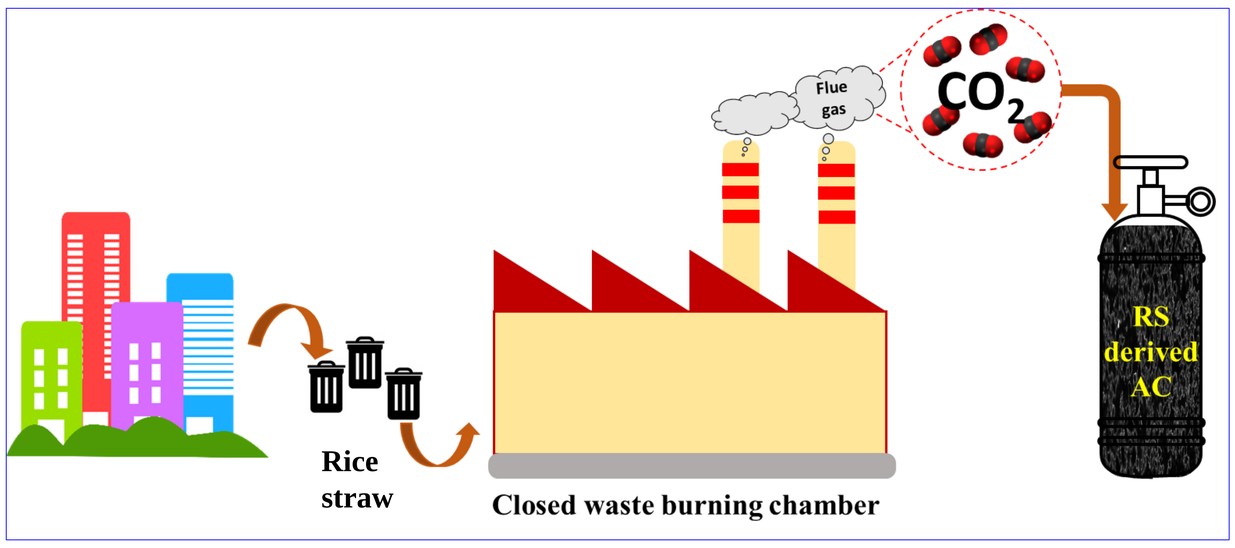

Fig 1: Burning food waste and capturing the CO_2 gas employing RS derived AC

Solution

- A **smart closed chamber** can be considered for burning the FW
- During the burning, **CO_2 gas will be produced**, which could be captured in an efficient way as it cannot be emitted to the atmosphere.
- This CO_2 gas will be **exhausted** to a closed adsorption chamber for the adsorption
- The adsorption chamber consists of adsorbent materials

Challenges !!

- The selection of **adsorbent materials** for **CO_2 capture is a crucial issue**
- **Biomass-derived AC** was found promising for capturing CO_2 as it has **high pore volume** and **high affinity to CO_2 molecules**
- **Rice straw (RS)** could be a great source for synthesizing biomass derived AC
- The burning of FW will generate charcoals, from which we can produce low-grade AC.

2. Methodology

- Activated carbon (AC) will be synthesized from carbonization of rice straw according the following steps
- Specific surface area, surface morphology, crystal structure, CO_2 adsorption capacity of the sample will be studied
- An adsorption chamber containing AC will be developed.

Step 1
- **Crushing** (particle size <5mm)
- **Air drying** (100 °C for 48 h)
- **Vacuum drying** (105 °C for 1h)

Step 2
- **Carbonization** (600 °C, inert atmosphere)
- **Powdered and sieved** (mesh size 100 μm)

Step 3
- **Activation** using potassium hydroxide (Biomass:KOH ; 1:4) and heating (900°C,inert condition)

Step 4
- **Washing** with HCl solution and deionized water
- **Drying** (110 °C)

3. Result and discussion

Fig 2: Synthesis steps of activated carbon

- Fig 2 shows the steps of the synthesis process
- Fig 3 presents the surface morphology of the sample
- Fig 4 represents the XRD pattern of the sample. The peak at 45° confirm the formation of activated carbon

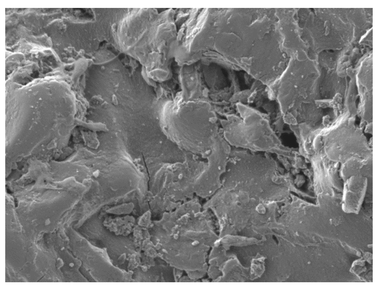

Fig 3: SEM image of activated carbon

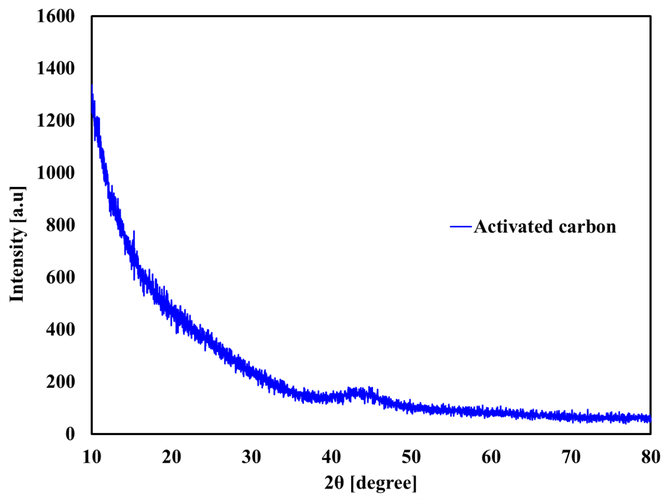

Fig 4: XRD pattern of activated carbon

5. Summary

- A smart closed Chamber will be developed to save the environment from air pollution.
- The co_2 produced will be stored by adsorption technology using activated carbon as adsorbent.
- We have successfully synthesized activated carbon in laboratory from rice straw.
- Surface morphology and crystal structure of the sample has been studied.
- Further structural characterization and adsorptive experiments will be done simultaneously
- Finally, an adsorption chamber with activated carbon will be developed.

References

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