

# Experimental investigation and performance optimisation of washing cycles for pre-processing of coal fly ash

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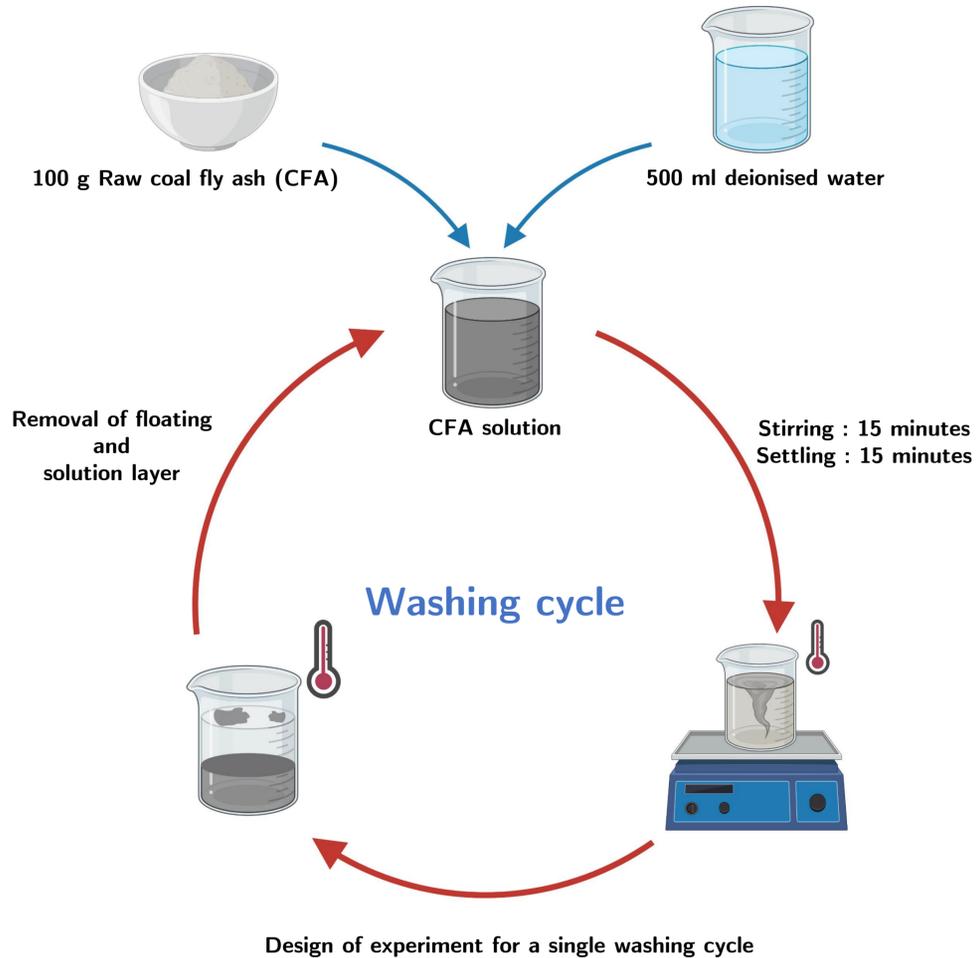
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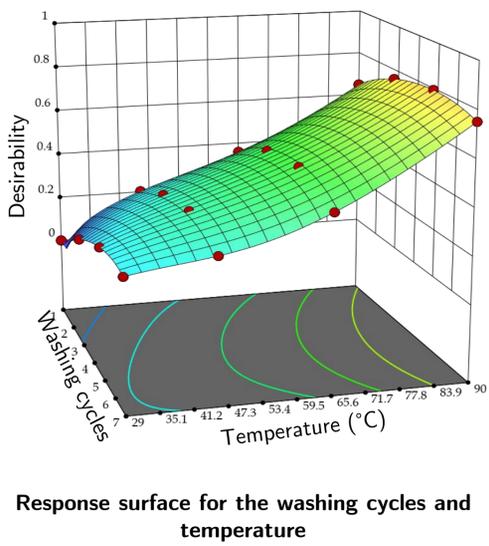
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## Research Highlights



- Pre-processing CFA is essential for the following reasons:
  - Presence of unburnt carbon
  - Presence of magnetic components
  - Availability of readily soluble ions
- Washing cycle found to be a promising primary pre-processing technique for CFA.
- Properties considered in this study are,
  - pH of the solution
  - Conductivity of the solution
  - Mean diameter of fly ash particles
- Washing the CFA five times (i.e., 15 minutes stirring and 15 minutes settling for five times) at 70 °C affirmed to be effective through response surface methodology.



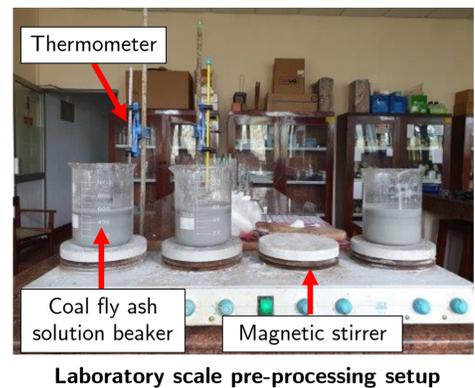
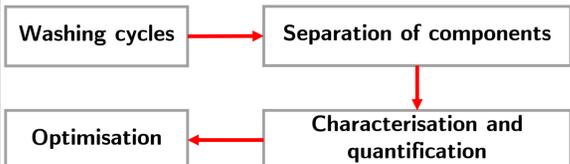
## Introduction



- Coal is the world's cheapest, most abundant, and widely distributed fossil fuel.
- Combustion of coal in powerplants produces coal fly ash (CFA) as one of the by products.

- CFA is a versatile as well as complex engineering material to benefit from.
- Pre-processing the CFA could lead to exploring and identifying the behaviour of CFA for further uses.

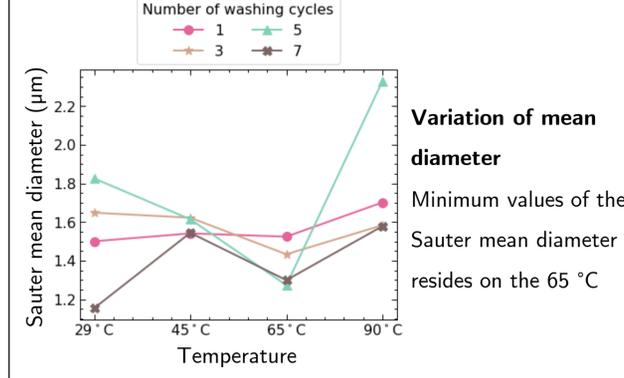
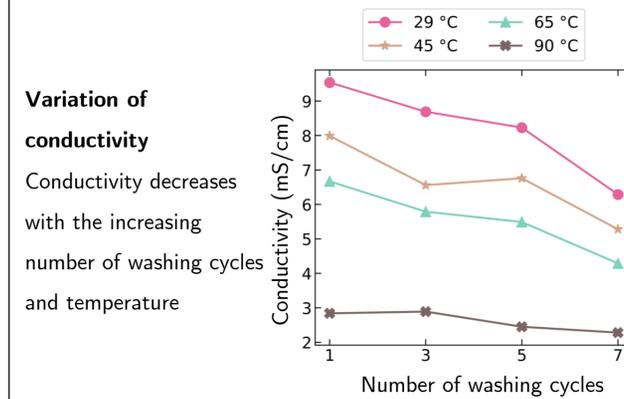
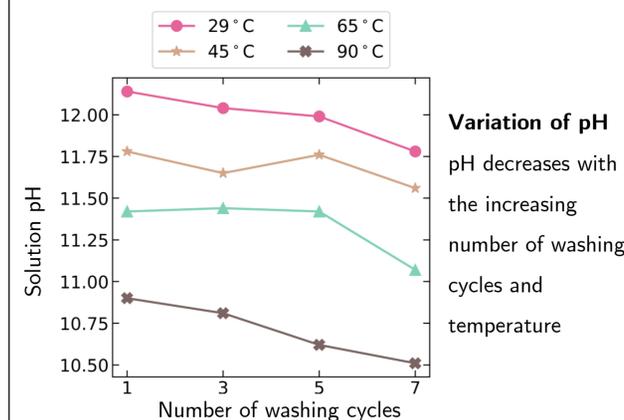
## Methodology



Independent variables	Dependent variables
Number of washing cycles	pH of the solution
Temperature	Conductivity of the solution
	Mean diameter of particles

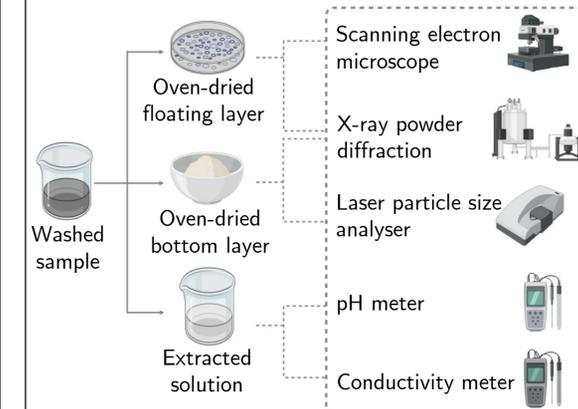
- Altogether 16 experiments consisting of 1, 3, 5, and 7 washing cycles at 29 °C, 45 °C, 65 °C, and 90 °C were performed for this study.

## Results & discussion



- The observed trends in the pH and conductivity are attributed to the dissolution of readily soluble ions.
- Removal of the surface layer of the particles resulted in the decreasing Sauter mean diameter; however, the uncertainty in the trend is due to the attractive forces between nanoparticles
- The characterisation of the recovered floating layer revealed promising avenues for future studies.

## Characterisation & optimisation

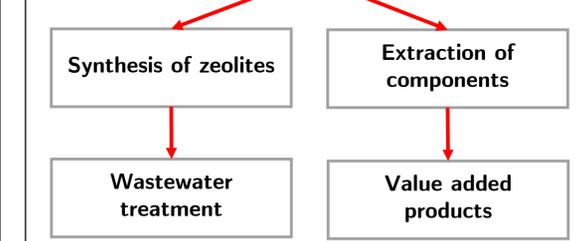


- Model limitations for the response surface design:
  - Minimum pH of solution
  - Minimum conductivity of solution
  - Minimum Sauter mean diameter of washed particles

## Conclusions & future work

- The number of washing cycles and the temperature has a significant influence on the physical and chemical attributes of coal fly ash (CFA).
- Washing the CFA five time at 70 °C deemed to be effective from the response surface methodology.

## Pre-processing of CFA



- Back tracking the sources and characteristics of the parent coal from its CFA.

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