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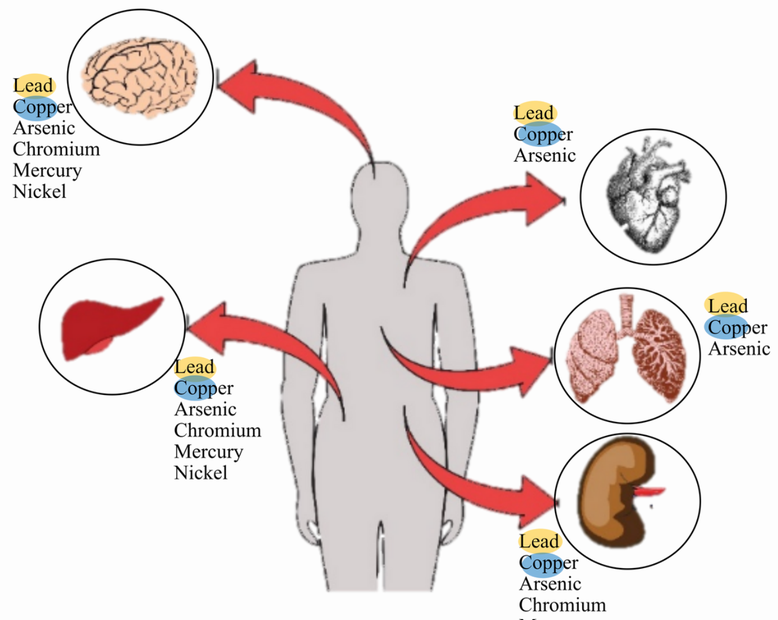
Alkali Activated Material Adsorbent

PRODUCT BACKGROUND

- The existence in industries of toxic metals created by mineral processing causes a significant threat to the water environment. Metal ions are often non-biodegradable products, and high amounts may cause damage to the human body, animal and ecological environment.
- Copper, lead, nickel, silver, and zinc are frequent heavy metals in industrial wastewater.
- Copper and lead overdose in the human body causes headaches, cardiovascular diseases, liver and kidney failure. Thus, removing these metal ions from industrial waste to water is important to reduce heavy metal exposure.
- These products are from geosynthesis reaction from aluminosilicate precursor and alkaline activator solution which is a new technology of self-supported geopolymer materials that have good physicochemical properties of adsorbents which are large surface area, isotropic pore size distribution, available polar sites, and reproducibility in the degree of activation.
- Additions of foaming agents increased the porosity and consequently the permeate flux with reasonable compressive strength.



PROBLEM STATEMENT

Conventional ceramic/membrane and adsorbents fabrication and processes have complicated chemistry and high cost.
The heat treatment required up to 1600 ℃.

Previous foaming agent produce non homogeneous, unevenly distributed porosity and difficult to control.

OBJECTIVE

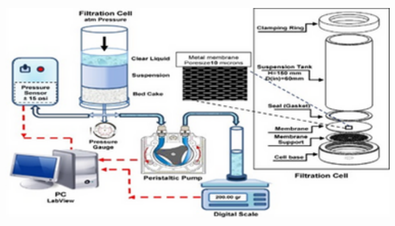
Utilization of clay-based aluminosilicate sources as a raw material for AAM production with high adsorbents properties for reducing copper and lead exposure

Implementation of alkali activation technique with hydrogen peroxide addition will reduce synthesis cost, as no sintering will be needed

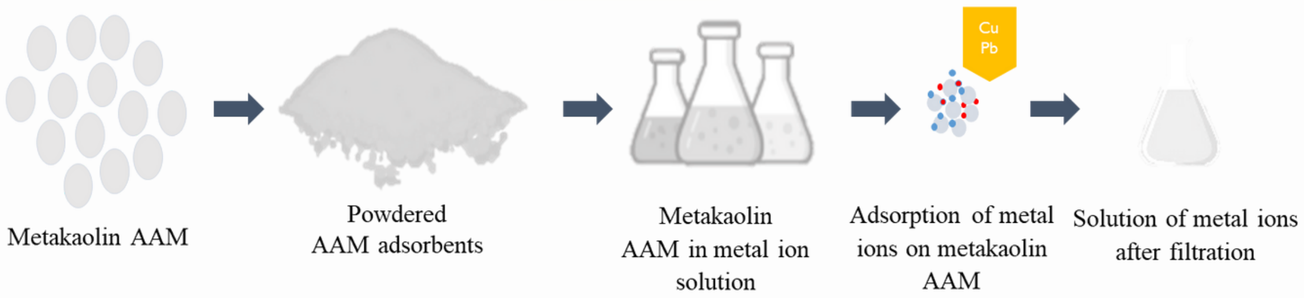
APPLICATION

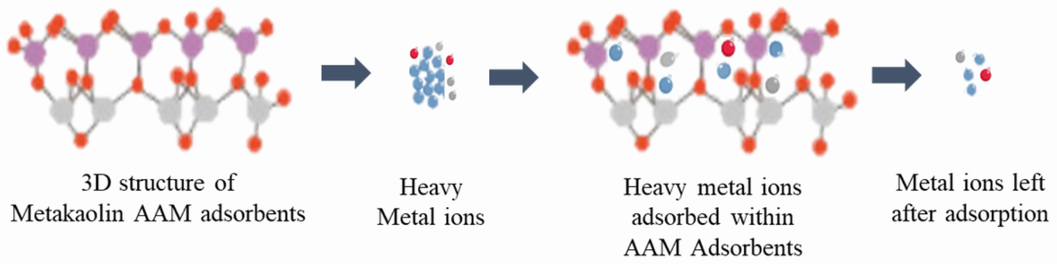
Heavy metal removal for industry wastewater

Nano-dead end filtration system



METHODOLOGY





NOVELTIES

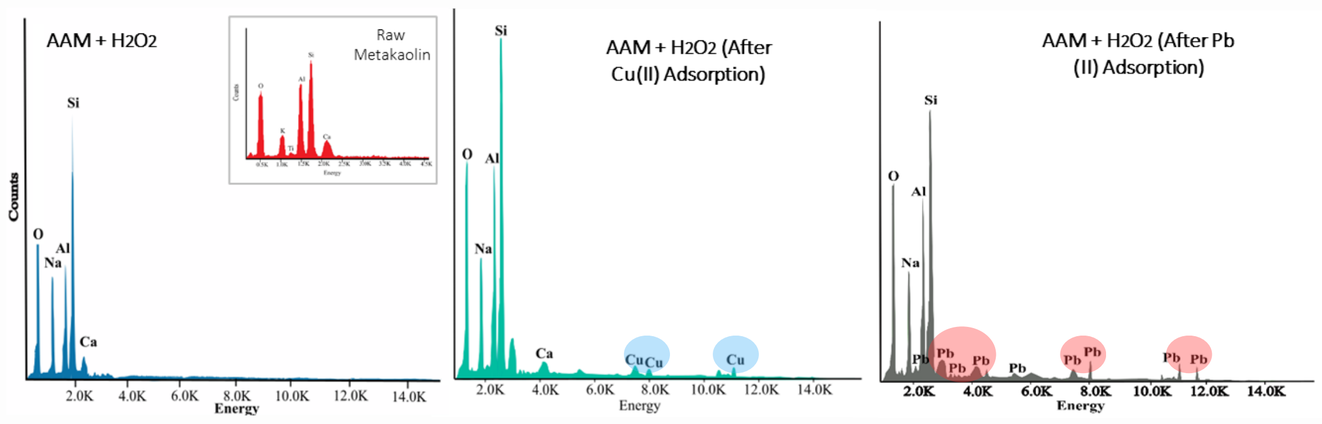
1. Transformation of metakaolin powder into alkali activated material based for Cu (II) and Pb (II) removal
2. Sintering free AAM and self supported with simple synthesis process
3. Dead end microfiltration for produced water through prepared adsorbent
4. Alternative low-CO2 binders that can be used in place of Portland cement.
5. Flexibility in design and operate for maximizing amounts of heavy metals adsorbed.
6. Developing cost-effective and sustainable methods for precursor preparation with excellent performance

PRODUCT ANALYSIS

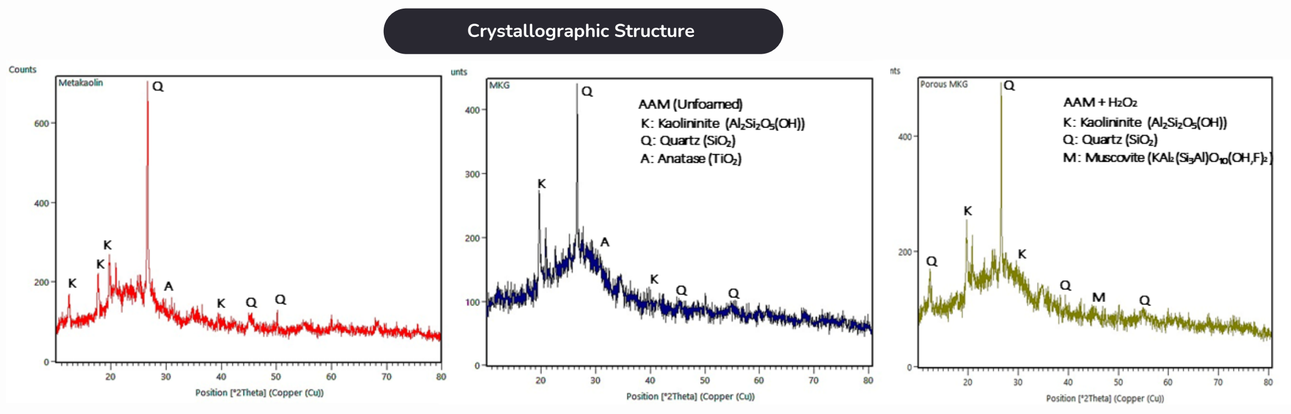
Surface Area and Pore Size Distribution

Properties	Unfoamed AAM	Foamed AAM
Water Absorption	5.02 %	32.24 %
Density	2.021 g/cm3	1.132 g/cm3
Specific Surface Area	9.6 m2/g	28.5 m2/g
Pore Volume	0.034969 cm3/g	0.194348 cm3/g

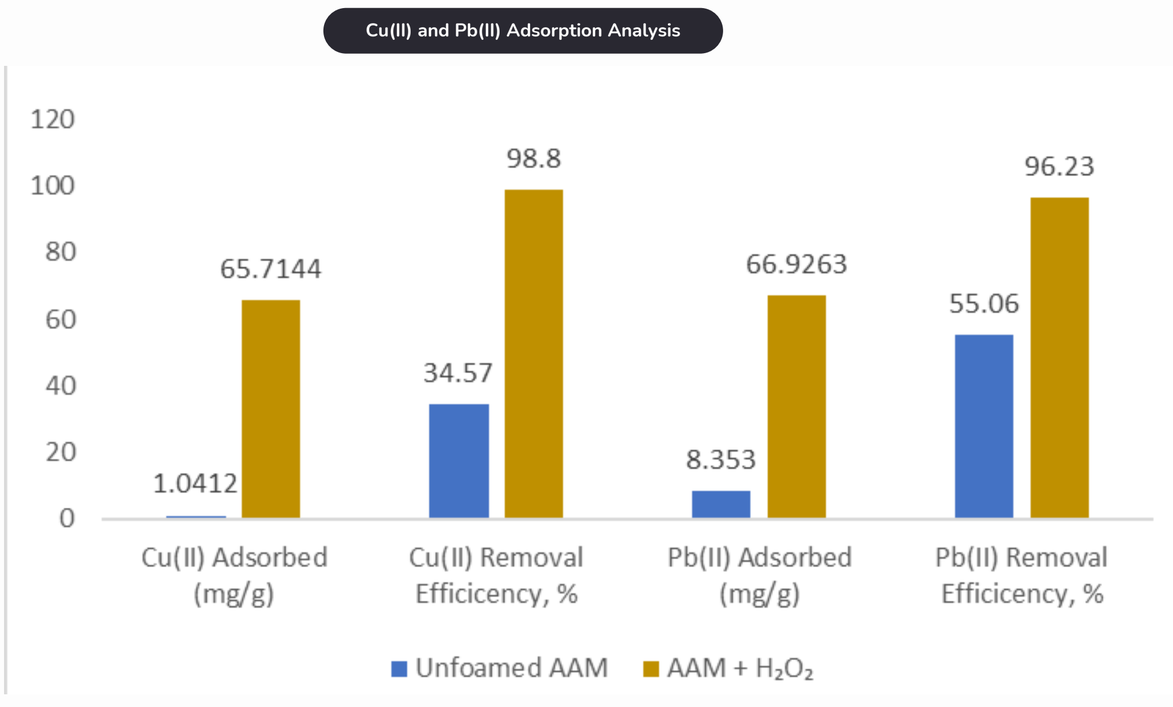
Elemental Analysis



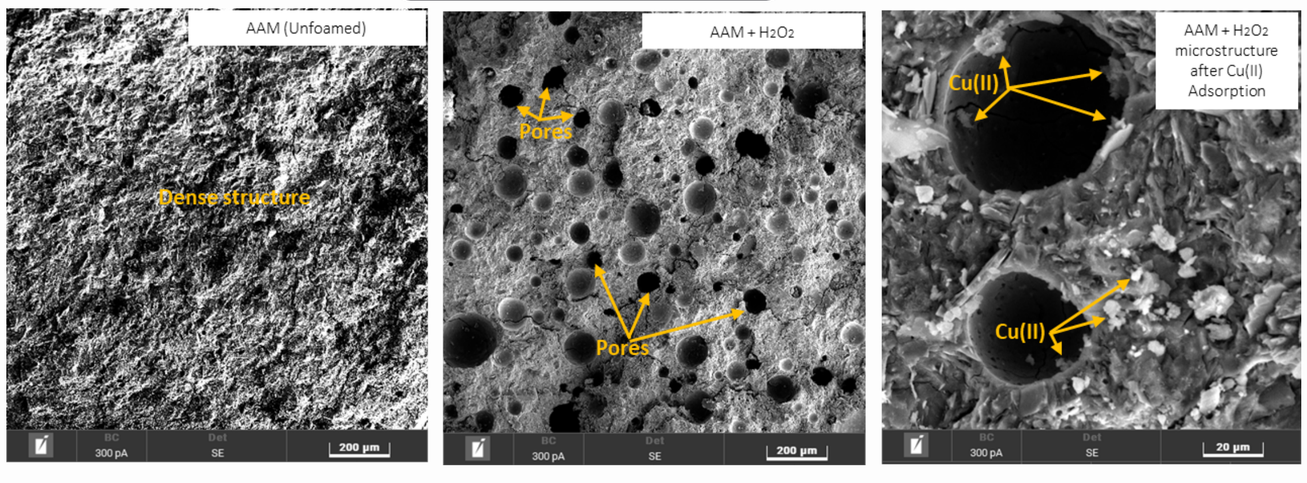
Crystallographic Structure



Cu(II) and Pb(II) Adsorption Analysis



Microstructural Analysis



Publication

- A Review of Geopolymer Based Metakaolin Membrane as an Effective Adsorbent for Waste Water Treatment.
- Effect of Solid to Liquid and Na_2SiO_3 to NaOH Ratio on Metakaolin Membrane Geopolymers.
- The Influence of Foaming Agent Towards Metakaolin Based Alkali Activated Materials Properties And Cu^{2+}Adsorption.
- Synthesis of Metakaolin based Alkali Activated Materials as an Adsorbent at Different Na_2SiO_3/NaOH Ratios and Exposing Temperatures for Cu^{2+} Removal
- Hydrogen Peroxide Modification Enhances the Ability of Metakaolin based Alkali Activated Materials Adsorbent to Remove the Ni^{2+} Ions
- Chemical Distributions of Different Sodium Hydroxide Molarities on Fly Ash/Dolomite-Based Geopolymer.