



# Sulfur Cycle Technology

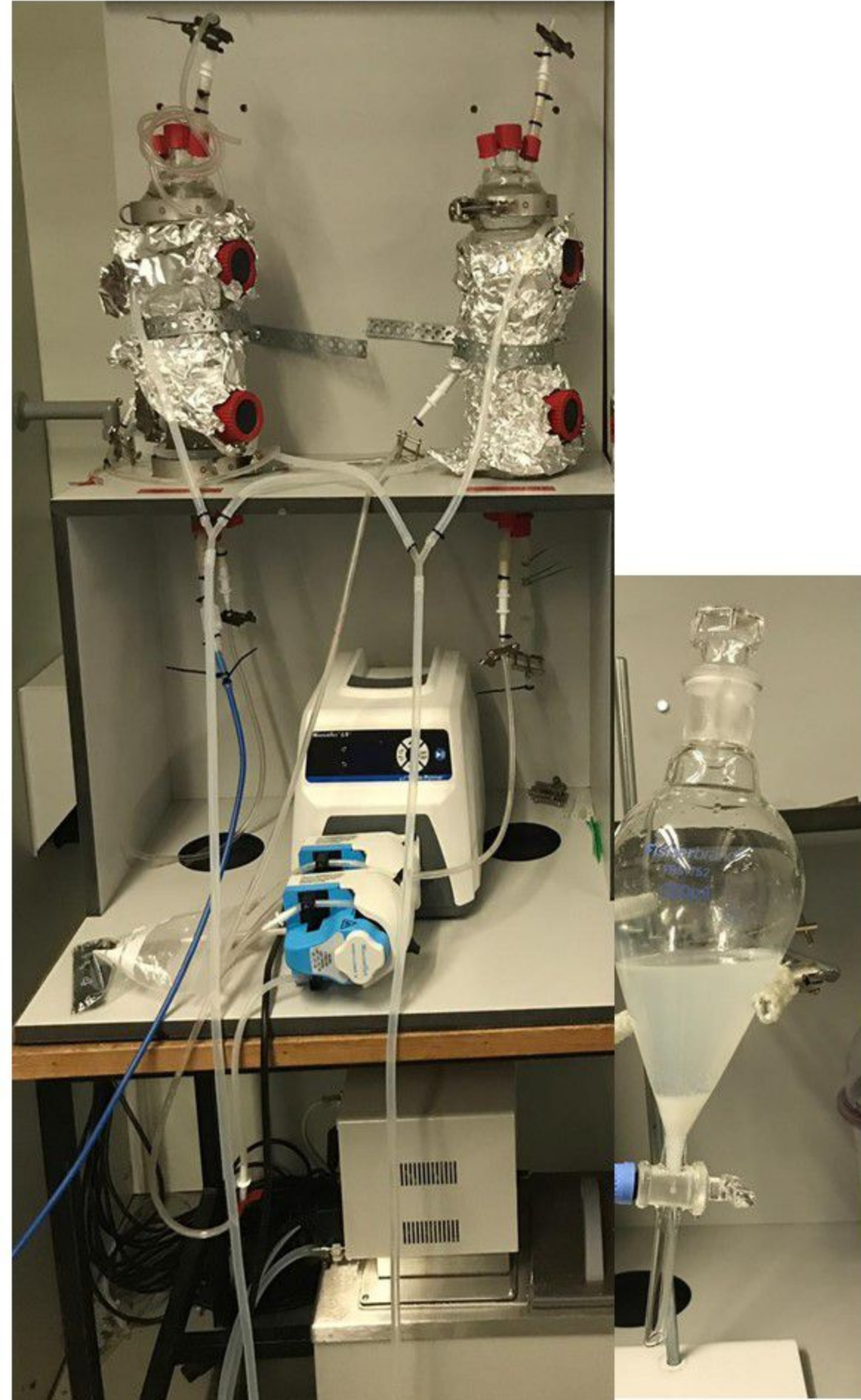
Biological sulfidogenic processes for metal recovery

Sulfur technologies for metal recovery

Denitrification of wastewater using sulfur compounds

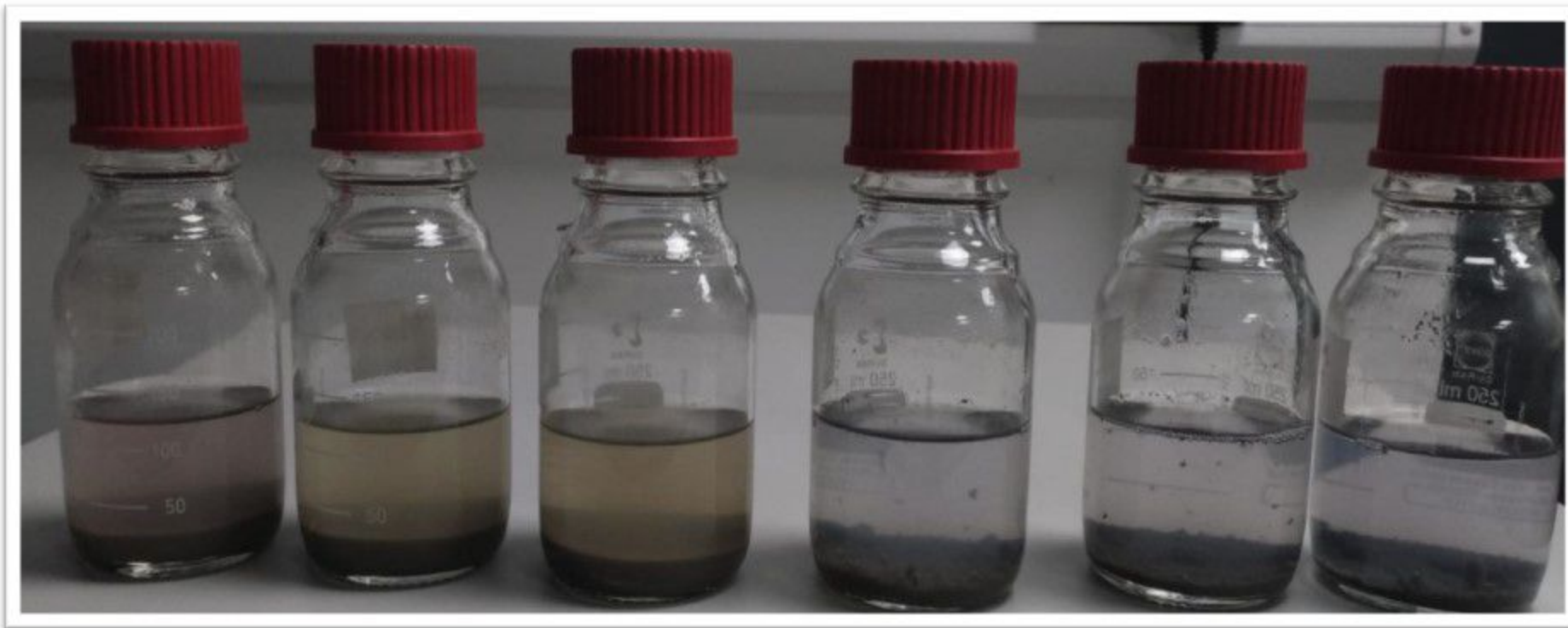
Selenium removal and biofortification

Anna P. Florentino



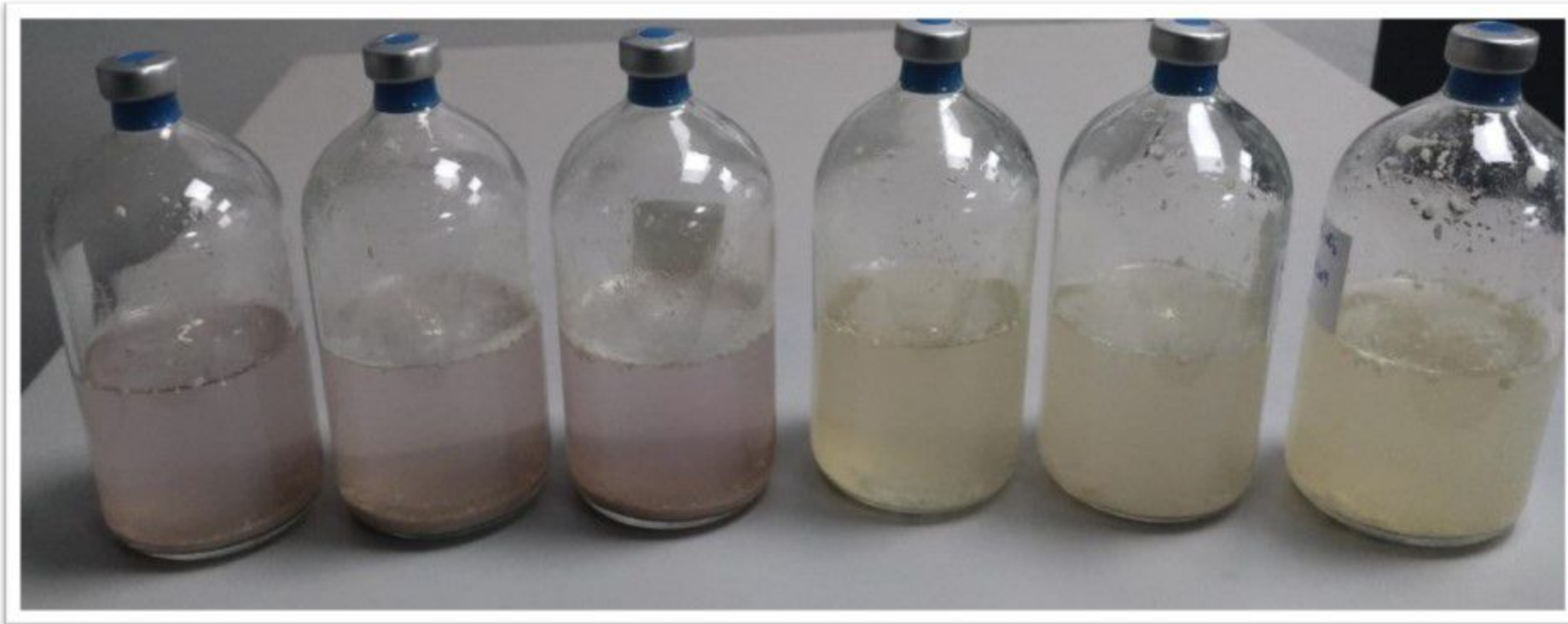
The high levels of sulphide produced from the degradation of long chain fatty acids, due to their high energy density, can be utilized for the precipitation of heavy metals in solution, which is of great relevance from the biotechnological point of view.

**Maria Federica Carboni**



Pyrite batch reactors

Pyrite batch reactors



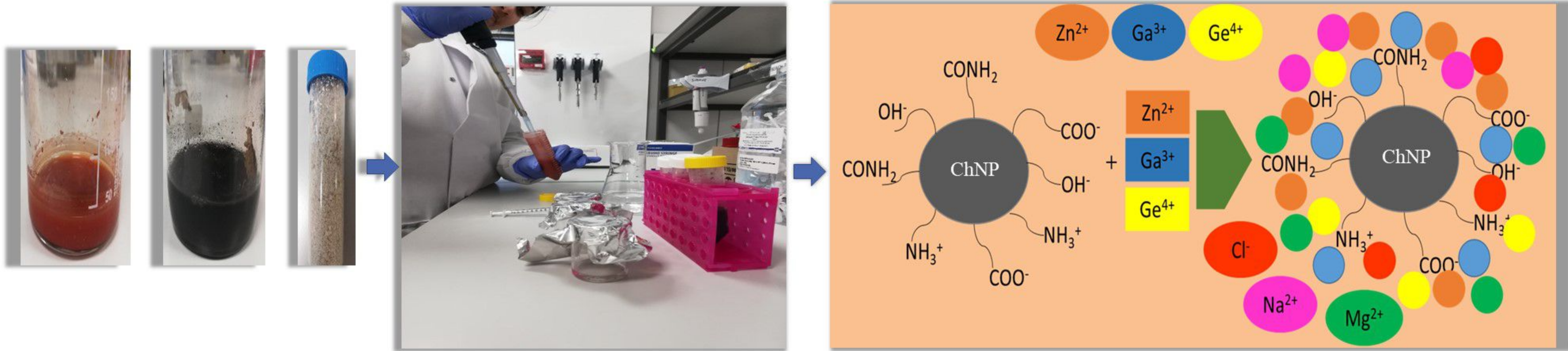
Elemental sulfur batch reactors

Elemental sulfur batch reactors



This set up is composed by several set of batch reactors. The volume is 250 mL and the working volume is 125 mL. The gas in the head space is argon, each bottle is flushed for 1 min to remove air, and left with a final pressure of 1.5 bar. They are kept at 30 C without agitation. They are fed With synthetic wastewater composed by 20 mM nitrate and different electron donors: pyrite, elemental sulfur, thiosulfate and sulfide.

**Sudeshna Saikia**



Elemental forms of sulphur ( $S^0$ ), selenium ( $Se^0$ ) and tellurium ( $Te^0$ ) are important intermediate in their respective natural cycle. Incomplete oxidation of sulphide in gaseous streams under oxygen-limiting conditions by S-oxidizing microorganisms leads to the production of biogenic  $S^0$ . Similarly, biological  $Se^0$  and  $Te^0$  can be produced from Se and Te laden wastewaters. The particles generated by biological means are hydrophilic, with a structure made of orthorhombic or monoclinic crystals surrounded by a hydrated layer of long-chain polymers or polythionates. Chemical composition and small particle size of these particles largely improve their (bio) chemical reactivity and make them highly potent candidate as adsorbent for metal recovery technologies.

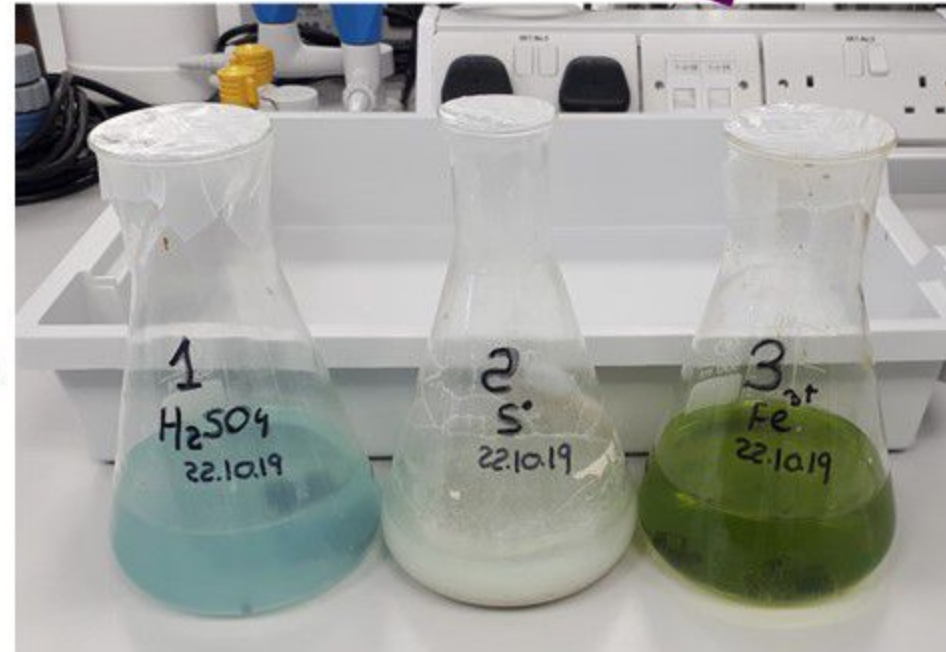
## Arrate Santaolalla, Arindam Sinharoy

This set up is composed by three different batch reactors. The working volume is 300 mL of three different leaching media in 500 mL volume flasks. A piece of PCB is introduced in each media and kept at 30 C and a shaking of 150 rpm, until the metals present in PCB are dissolve. After the leaching process the metals contained in the leaching solutions are precipitated using biogenic sulfide generated by sulfur-reducing bacteria.

### PCB LEACHING IN THREE DIFFERENT MEDIA

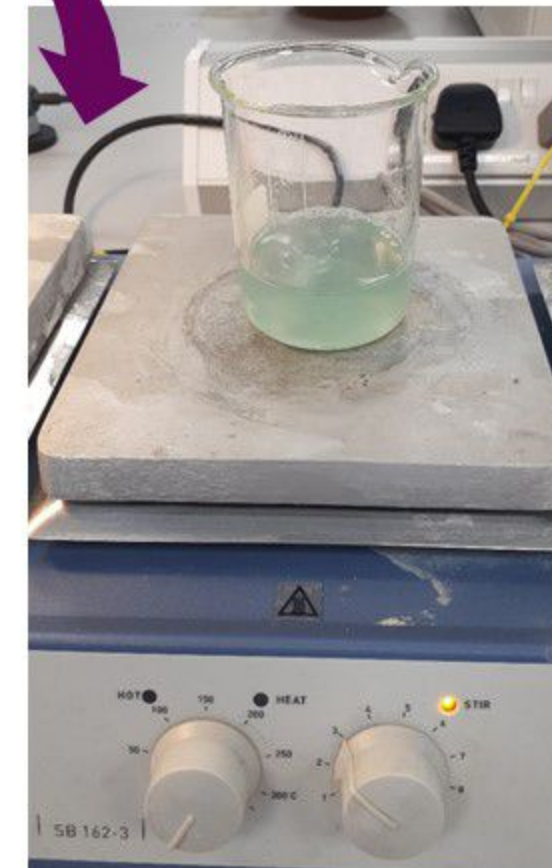


Leaching media and PCB before leaching process



Leaching media and PCB after 300 hours of leaching process

### METAL PRECIPITATION BY BIOGENIC SULPHIDE



Leaching solution before metal precipitation



Leaching solution during metal precipitation