



# Leaching of Cu-Zn, Zn-Pb and Cu-Zn-Pb tailings using salt-containing water sources and combined processes with bioleaching

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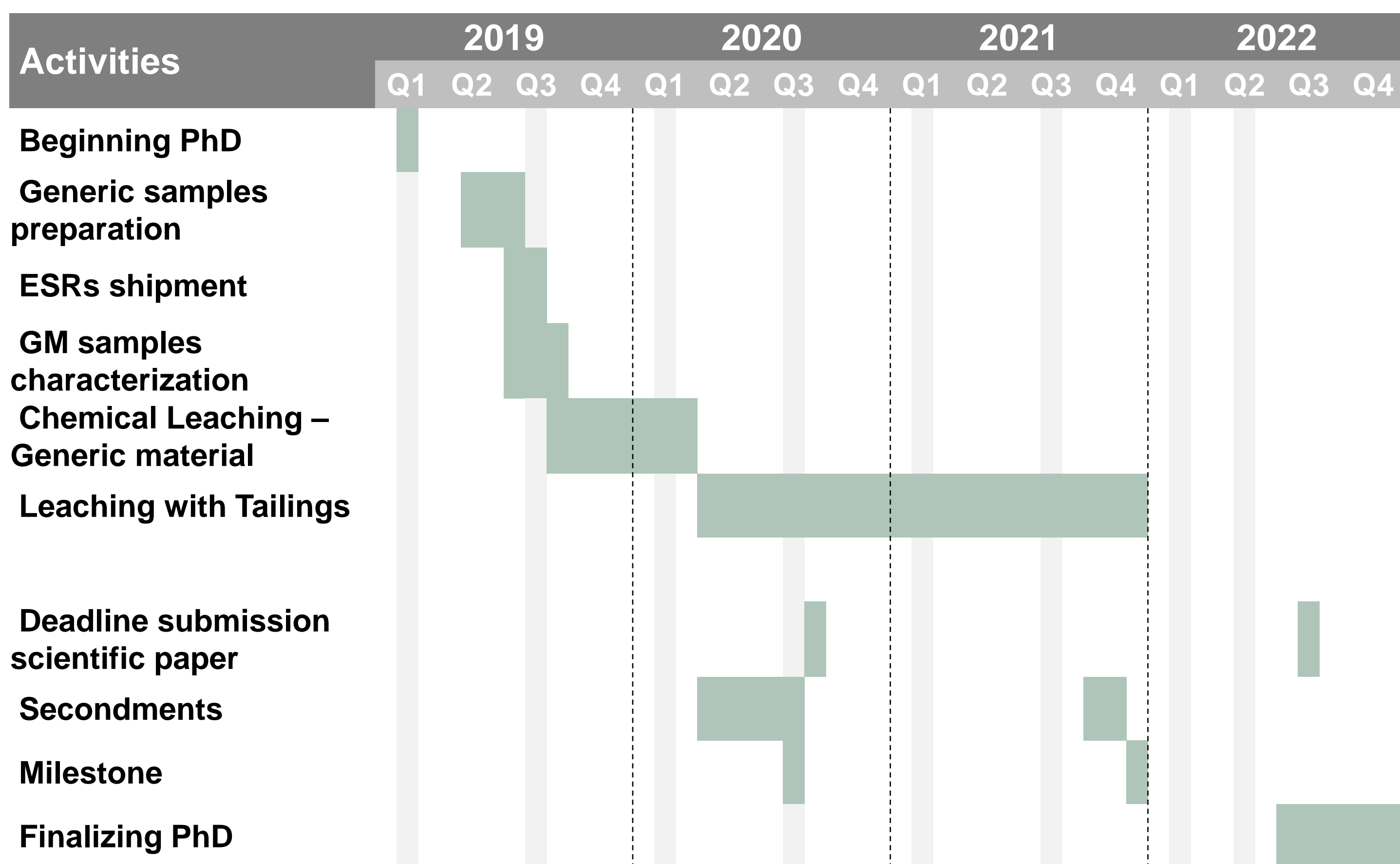
## INTRODUCTION

The use of saltwater sources will become a relevant alternative in leaching processes in regions where freshwater is scarce. The dissolved amount of ions may have a significant impact on leaching behavior. One very important source could be seawater. The physicochemical behavior of seawater ions can have positive and negative effects in mineral processing and extraction. For this reason, a better understanding of its behavior becomes necessary.

## OBJECTIVES

Developing leaching processes with salt-containing water sources for regions where freshwater is scarce.

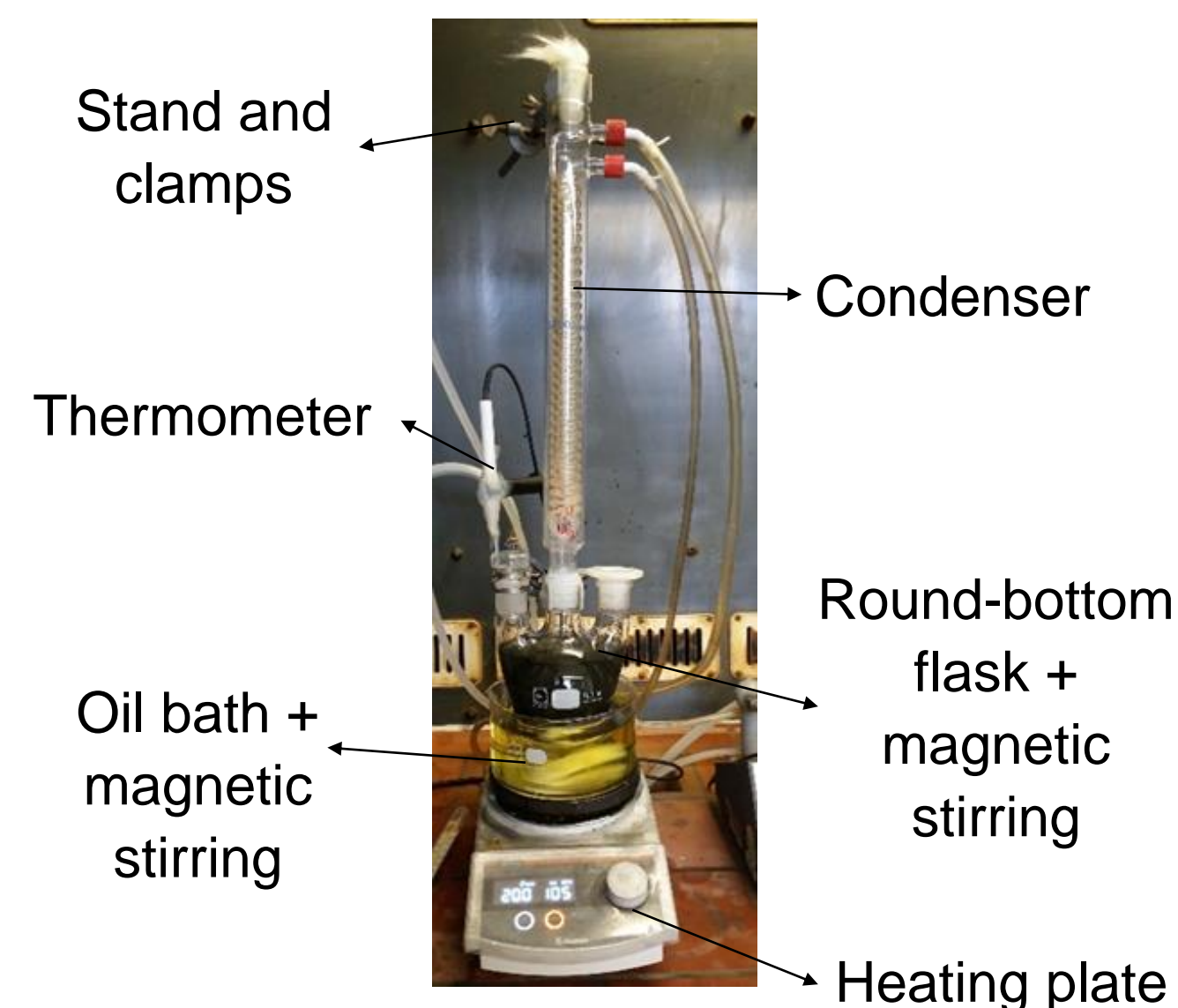
- The main objective of a first step is to understand the behavior of different sulfide minerals (starting with generic materials) under high concentration of saltwater ions.



## RESEARCH PROGRESS

Leaching solution	0.5M HCl + 1M NaX*
Grain size	D80<20µm
Sol/Liq ratio	1:100
Time	0-6h
Speed	250 rpm
Temperature	90°C
pH	<1.0

\*X = Cl<sup>-</sup> or SO<sub>4</sub><sup>2-</sup> or Br<sup>-</sup> or NO<sub>3</sub><sup>-</sup>



Vibratory disc mill: 4.5 min for chalcopyrite; 11 min for pyrite; 7 min for sphalerite; 4 min for galena.

## RESULTS AND DISCUSSION

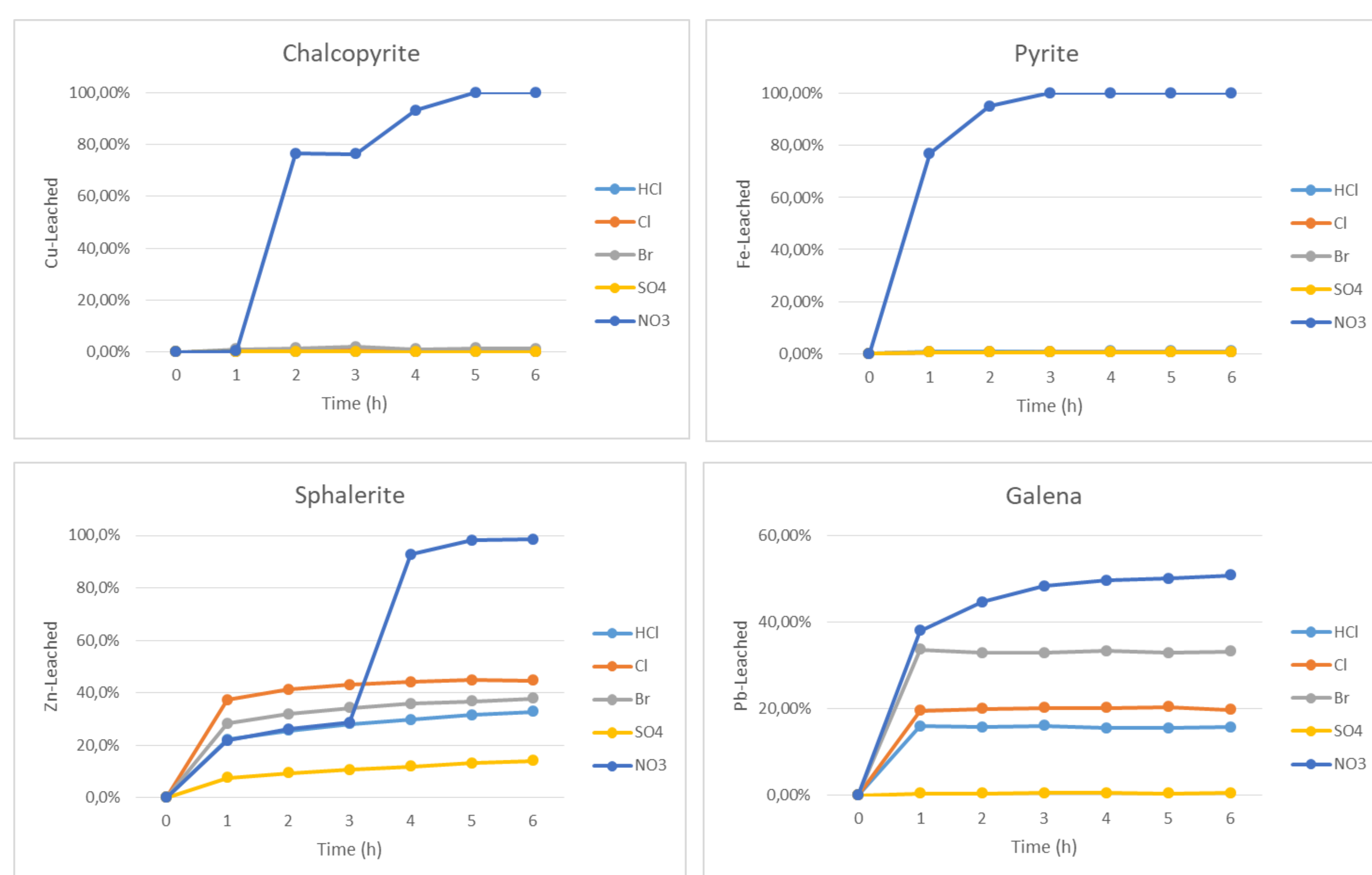


Figure 1: Leaching kinetics of target elements from SULTAN Generic Material\* under acid condition (0.5M HCl; pH < 1.0) with or without addition of salt (1M NaNO<sub>3</sub>, Na<sub>2</sub>SO<sub>4</sub>, NaBr or NaCl) for 6 hours at 90°C.  
\*SUL\_GM\_05\_Chalcopyrite; SUL\_GM\_06\_Galena; SUL\_GM\_08\_Pyrite; SUL\_GM\_10\_Sphalerite.

The pH was stable during the whole time of experiments. The redox potential was higher using NO<sub>3</sub><sup>-</sup>. Chalcopyrite and Pyrite showed massively higher leaching activities when nitrate was present. For all sulfides positive effects could be observed. Under the chosen conditions 100% of the Zn, Cu and Fe could be dissolved. Even Pb dissolution could be raised to 50%. Zinc extraction (Sphalerite sample) was also higher when NaCl and NaBr were added to the solutions, however the addition of Na<sub>2</sub>SO<sub>4</sub> did not increase the metal extraction. Since Galena is not well soluble in most inorganic acids, a combined leaching approach with bioleaching may generate results, potentially leading to complete or specified leaching.

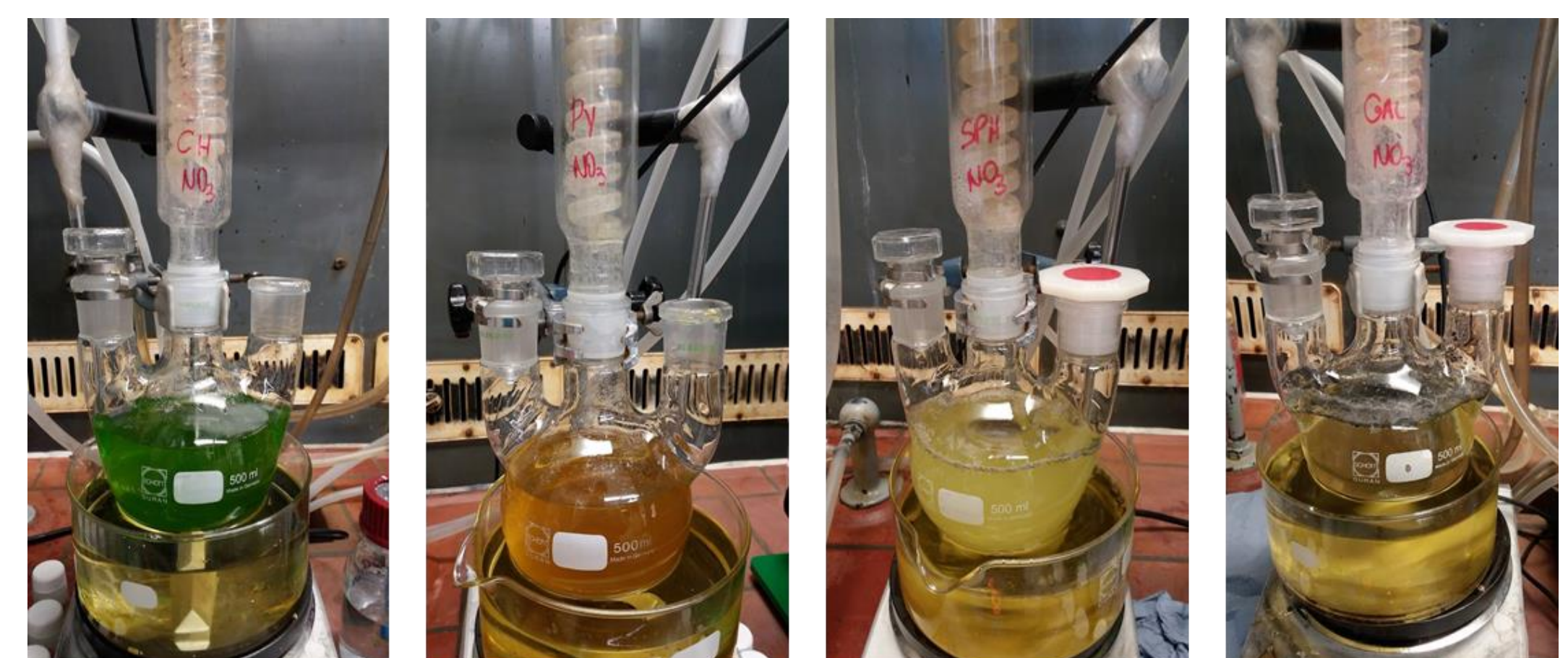


Figure 2: Chalcopyrite, Pyrite, Sphalerite and Galena leaching under addition of nitrate (0.5 M HCl + 1 M NaNO<sub>3</sub>) after 6 hours of experiment.

## UPCOMING STEPS

- Leaching of SUL\_GM under different conditions.
- Tailings samples preparation for Bioleaching secondment at HZDR (Germany).

