

SYNTHESIS OF IRON/ALUMINIUM CO-SUBSTRATE FOR COPPER CEMENTATION



***PRESENTED BY
MISS ARUNWAN TOTTIPPUMIRUK
DEPARTMENT OF MINING AND PETROLEUM ENGINEERING
FACULTY OF ENGINEERING CHULALONGKORN UNIVERSITY***

OUTLINE

Theoretical background

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Results and Discussion

Conclusion

1. Preparation of Fe/Al Co-substrate
2. Cementation of copper ion using Fe/Al Co-substrate

Theoretical background



Theoretical background

Hydrometallurgical methods has been broadly used for metal recovery in waste water treatment, ore treatment, resource recycling, electrolyte purification, etc. In general, hydrometallurgical methods consist of three main processes namely

- Leaching

- Solid-liquid separation

 - Chemical precipitation

 - Cementation

 - Ion-exchange

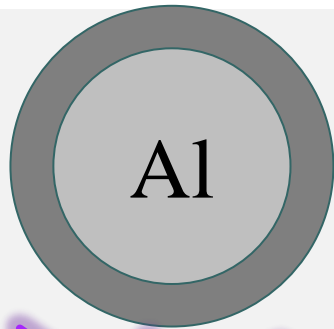
 - Reverse osmosis

 - Electrodialysis

 - Solvent extraction

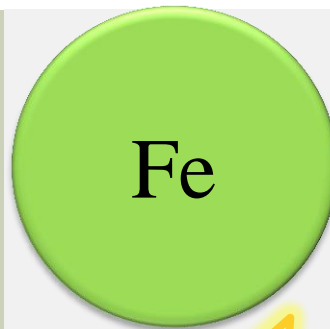
- Washing-collecting processes

Theoretical background



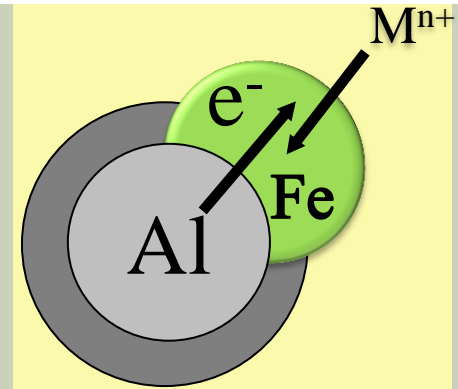
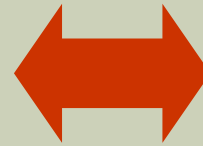
High
reducing
power

Oxide layer
Non
magnetic



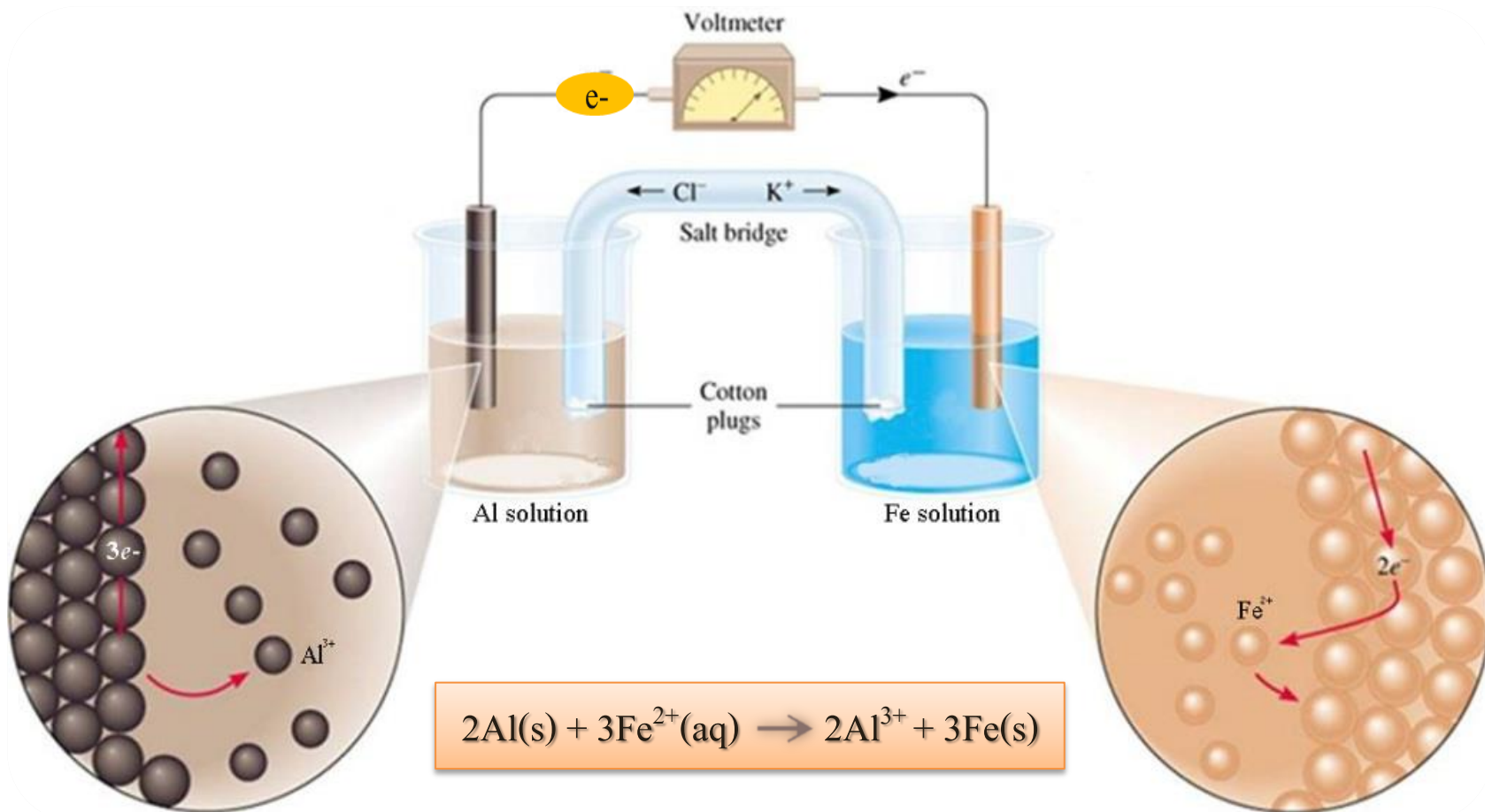
Magnetic
property

Potential
 $Fe > Al$



High
reducing
power
and
Magnetic
property

CEMENTATION AND ITS USE IN HYDROMETALLURGY



Objectives

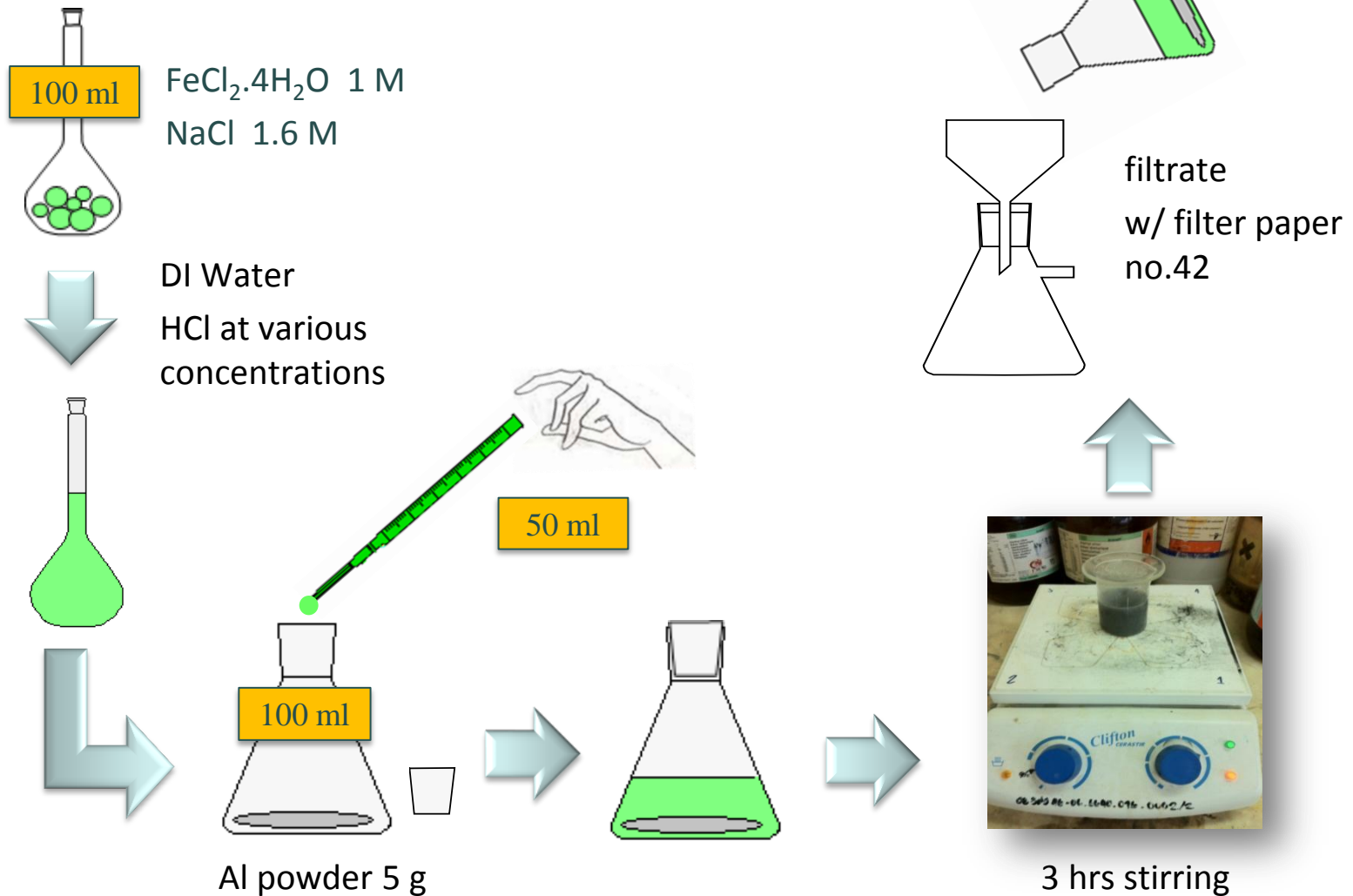
- ❖ To synthesize Fe/Al Co-substrate having both strong reducing ability of Aluminium and magnetic property of Iron
- ❖ To adsorb and recover copper ion from copper solution by cementation using Fe/Al Co-substrate
- ❖ To study effects of Iron on Fe/Al Co-substrate in copper cementation process

Methodology

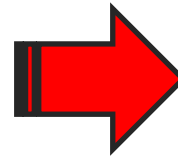
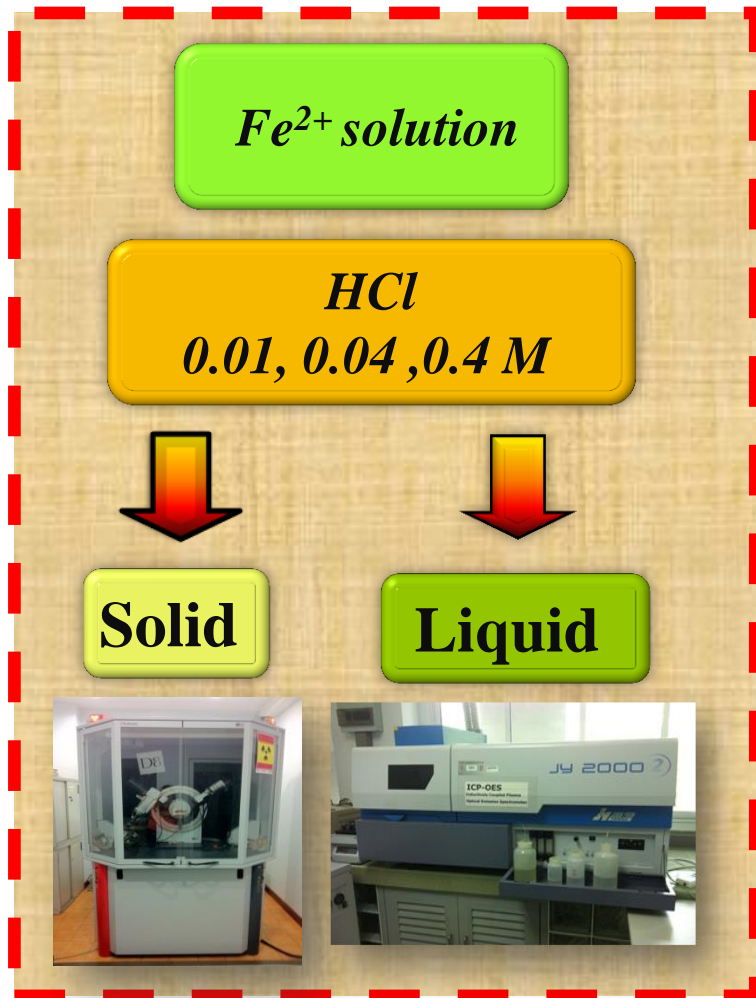
**1. Preparation of the Fe/Al Co-substrate
(Fe coated on Al)**

**2. Cementation of copper ion using
Fe/Al Co-substrate**

1. Preparation of Fe/Al Co-substrate (Fe coated on Al surface)



1. Preparation of Fe/Al Co-substrate (Fe coated on Al surface)



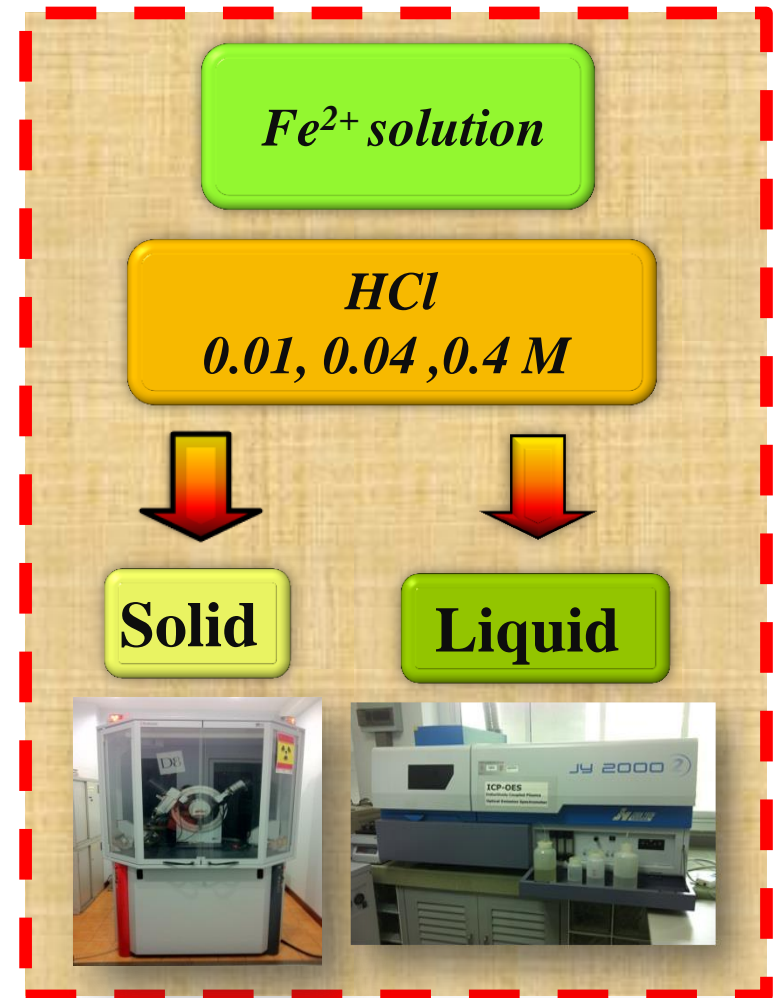
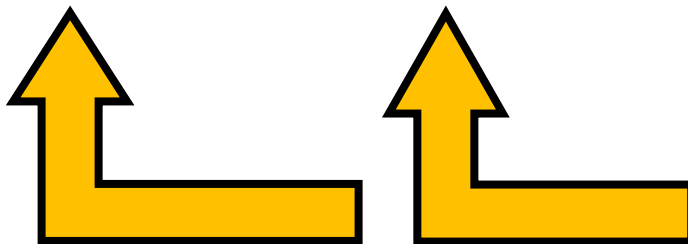
2. Cementation of copper ion using Fe/Al Co-substrate vs. Al substrate

Al powder
1 g

Cu solution
(1000 ppm)
10 ml

Fe/Al
Co-Substrate 1 g

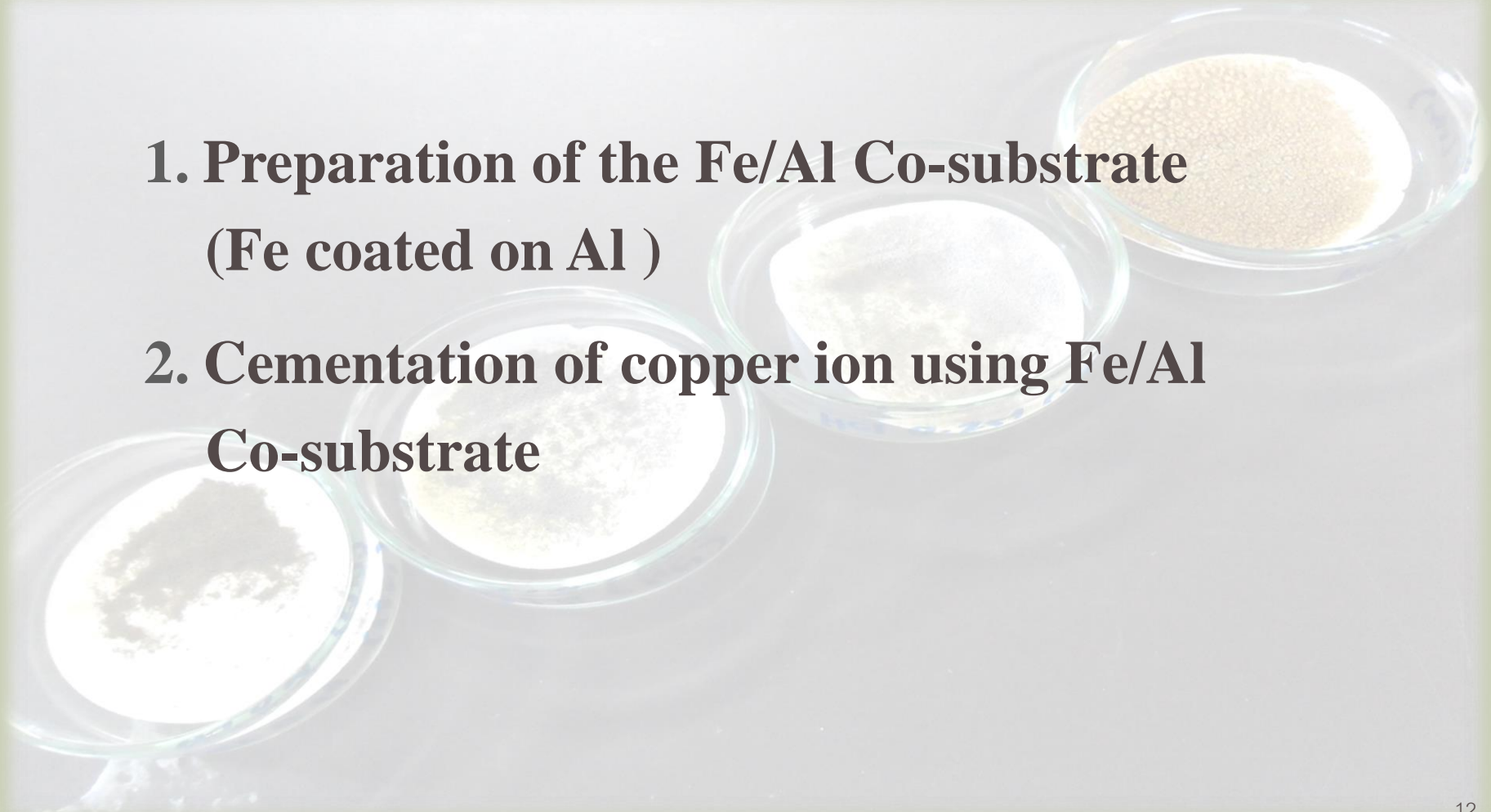
Cu solution
(1000 ppm)
10 ml



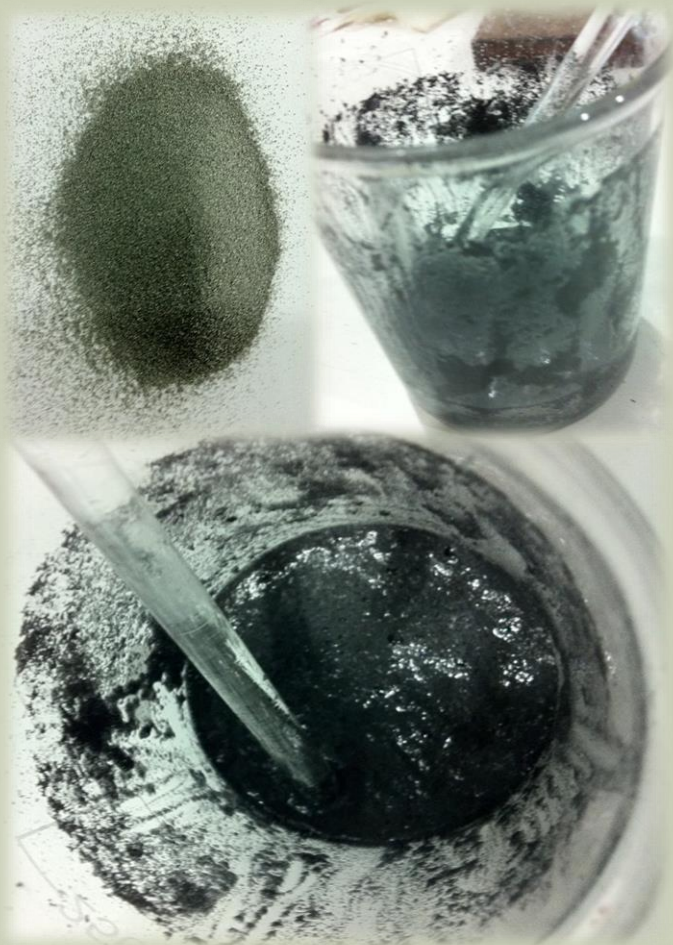
Results and Discussion

**1. Preparation of the Fe/Al Co-substrate
(Fe coated on Al)**

**2. Cementation of copper ion using Fe/Al
Co-substrate**



1. Preparation of Fe/Al Co-substrate (Fe coated on Al)



1M $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ 1.6M NaCl
0.4M HCl

Contact time 3.0
hours

Al dissolved

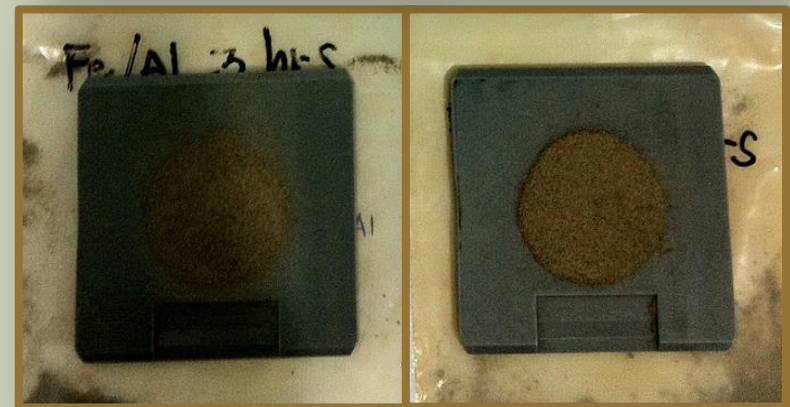


1. Preparation of Fe/Al Co-substrate (Fe coated on Al)

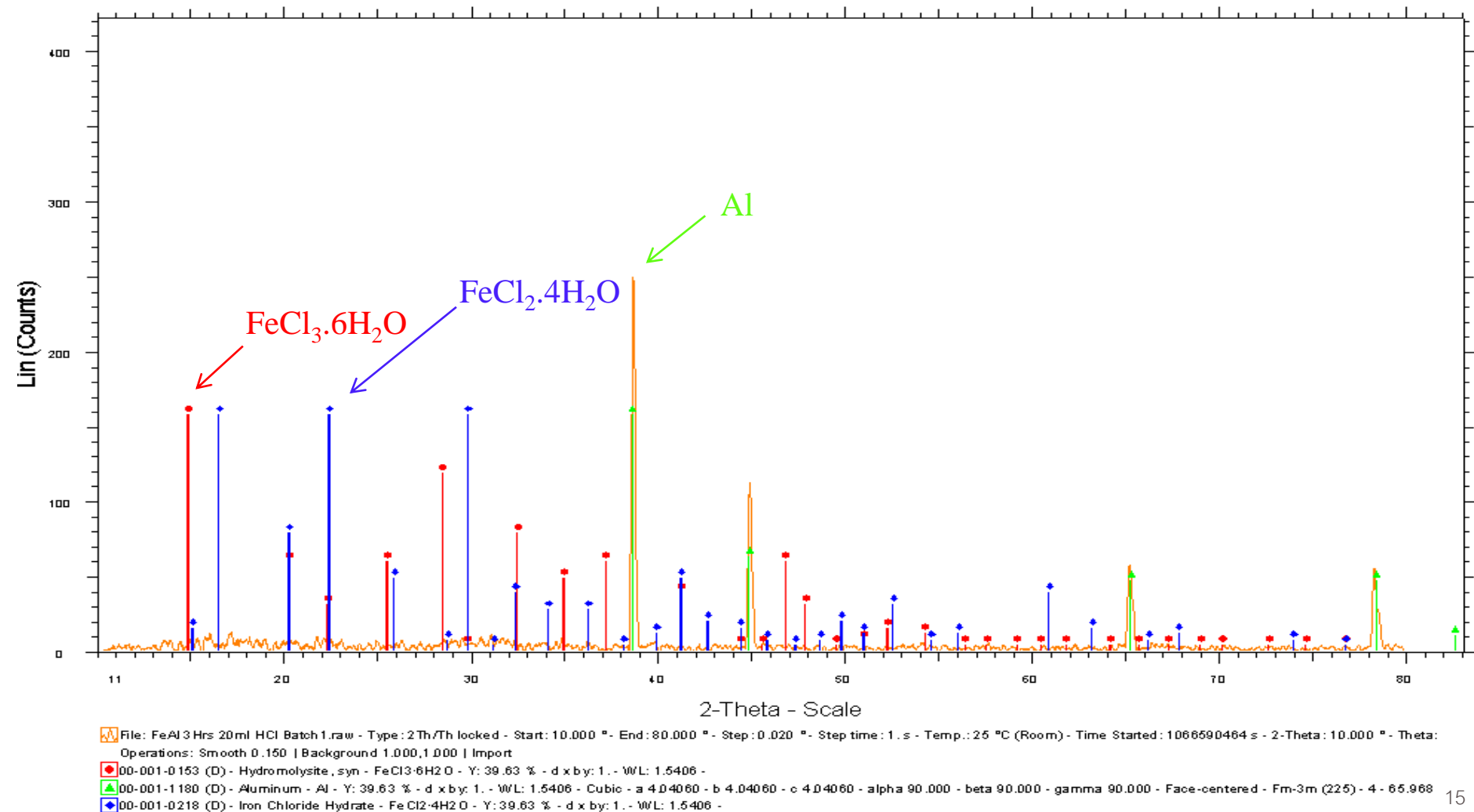
**1M FeCl₂ · 4H₂O 1.6M
NaCl 0.4M HCl**

**Adjusted pH
with NaOH**

**Contact time
1.5 and 3.0 hours**



1. Preparation of Fe/Al Co-substrate (Fe coated on Al)



1. Preparation of Fe/Al Co-substrate (Fe coated on Al)

Fe/Al
substrate

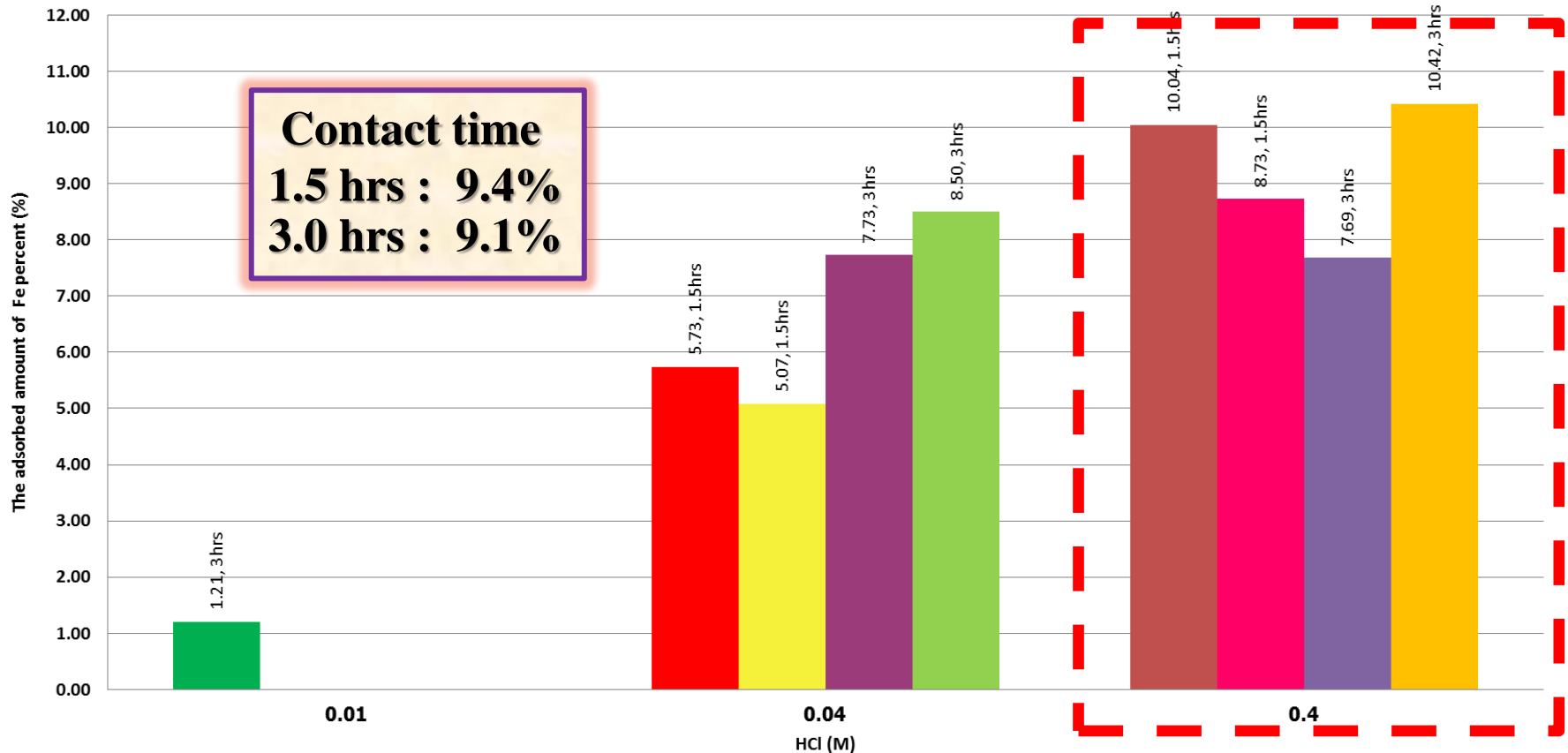
XRD: Al, $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$, $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$

$$\text{Adsorbed Ferrous}(\%) = \frac{Fe_{\text{initial}} - Fe_{\text{measure}}}{Fe_{\text{initial}}} \times 100$$



1. Preparation of Fe/Al Co-substrate (Fe coated on Al)

The correlation between HCl (ml) and the adsorbed amounts of Fe percent(%)



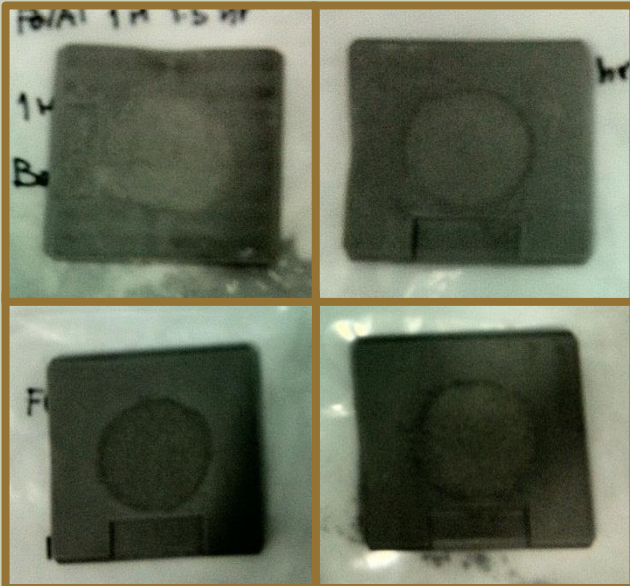
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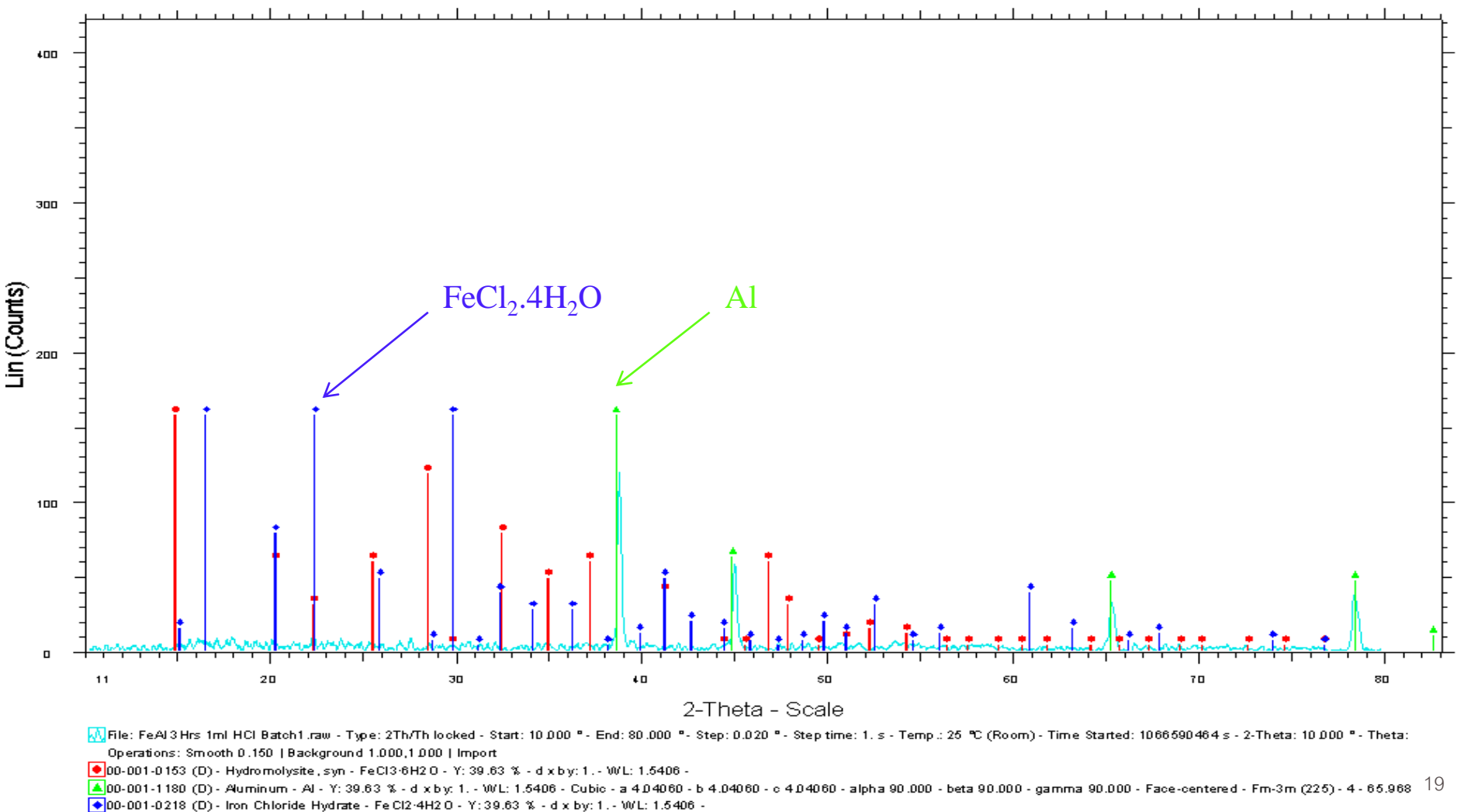
1M $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$ 1.6M NaCl
0.04M HCl

Contact time 1.5 and
3.0 hours

Green Solution 

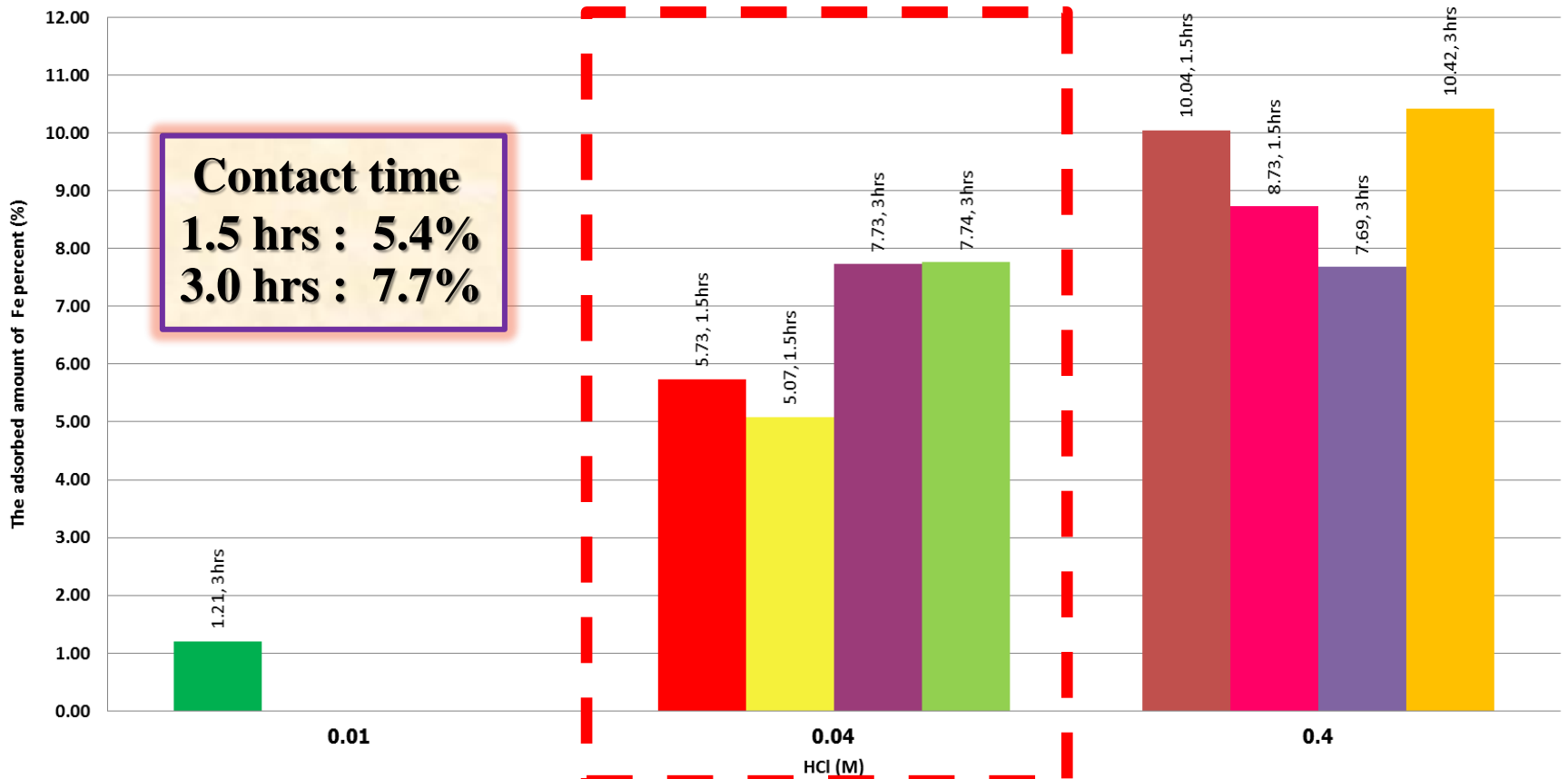


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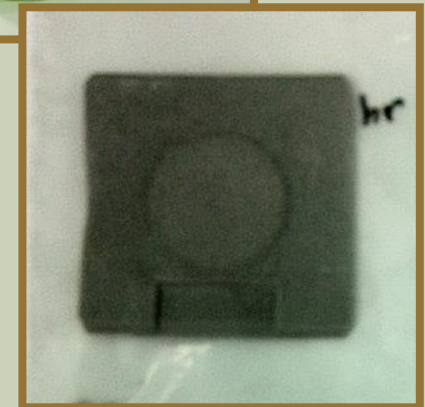
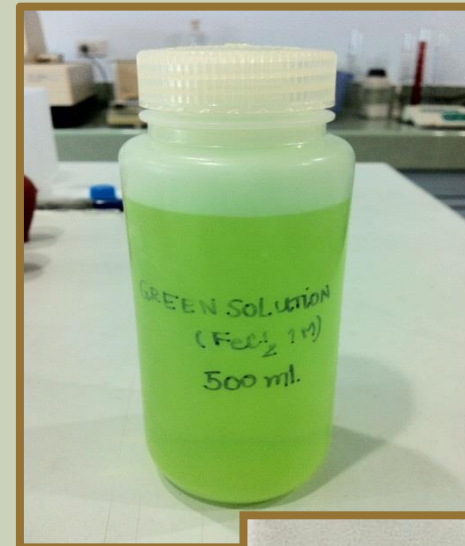


1. Preparation of Fe/Al Co-substrate (Fe coated on Al)

**1M FeCl₂ · 4H₂O 1.6M NaCl
and 0.01M HCl**

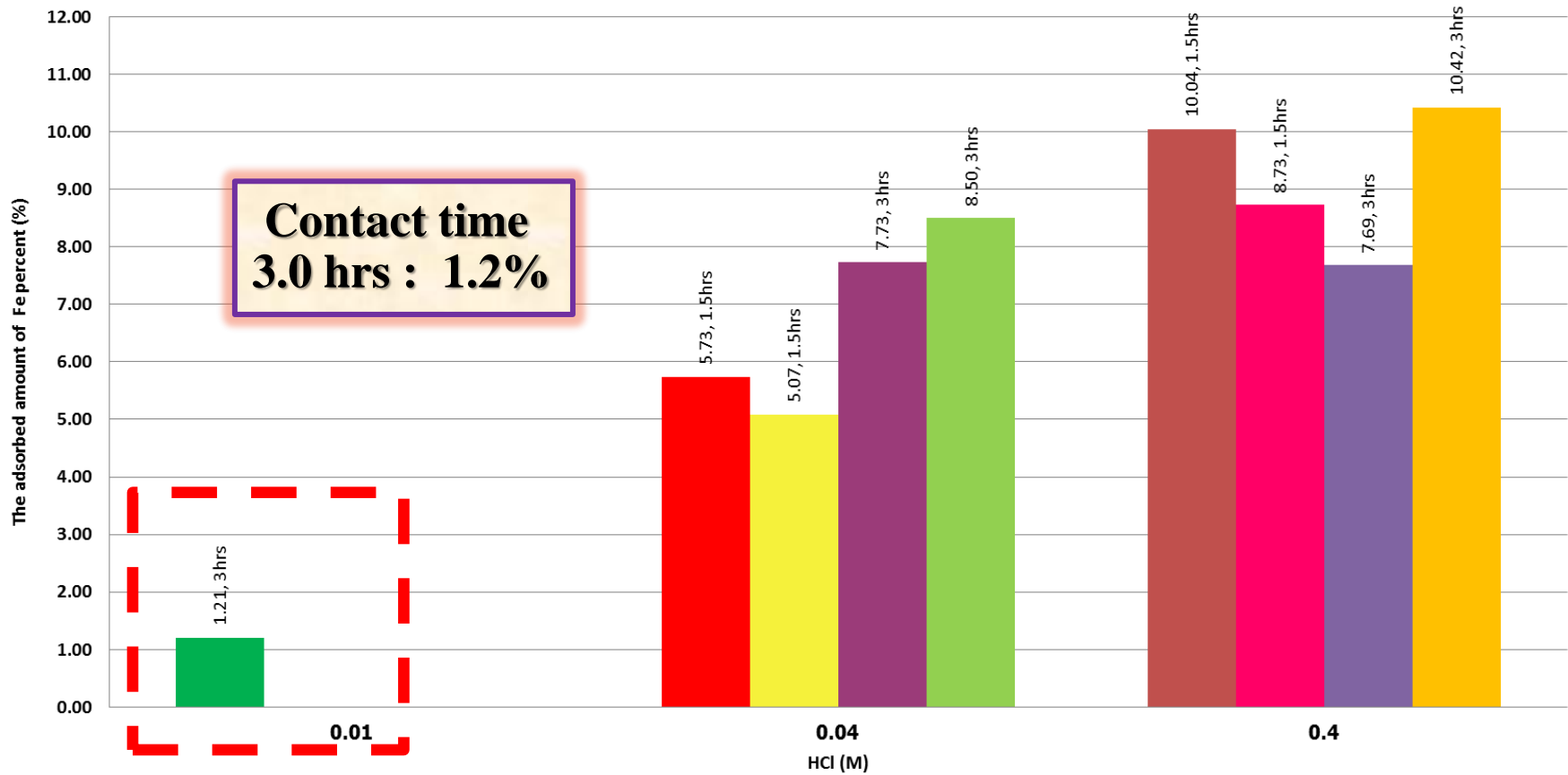
Green Solution

 **The adsorbed amount of
Fe was very low**



1. Preparation of Fe/Al Co-substrate (Fe coated on Al)

The correlation between HCl (ml) and the adsorbed amounts of Fe percent(%)



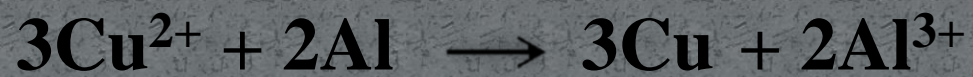
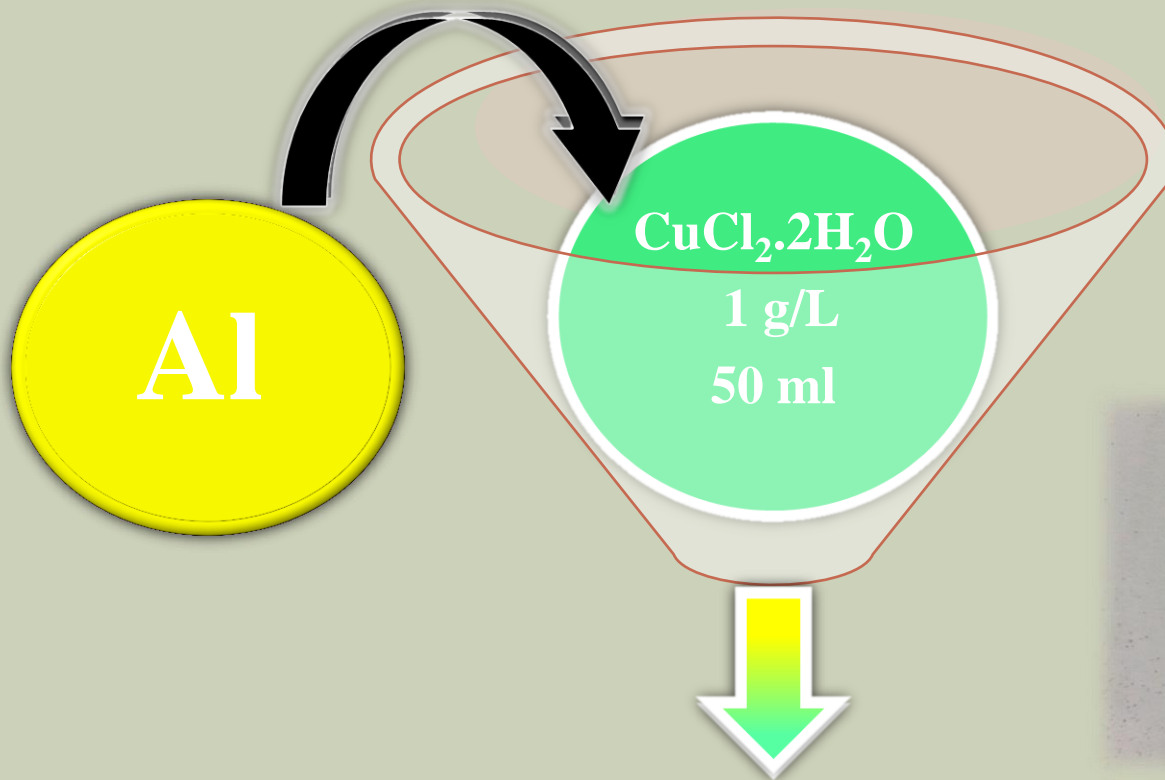
1. Preparation of Fe/Al Co-substrate (Fe coated on Al)

An optimum condition for
Synthesis Fe/Al Co-substrate

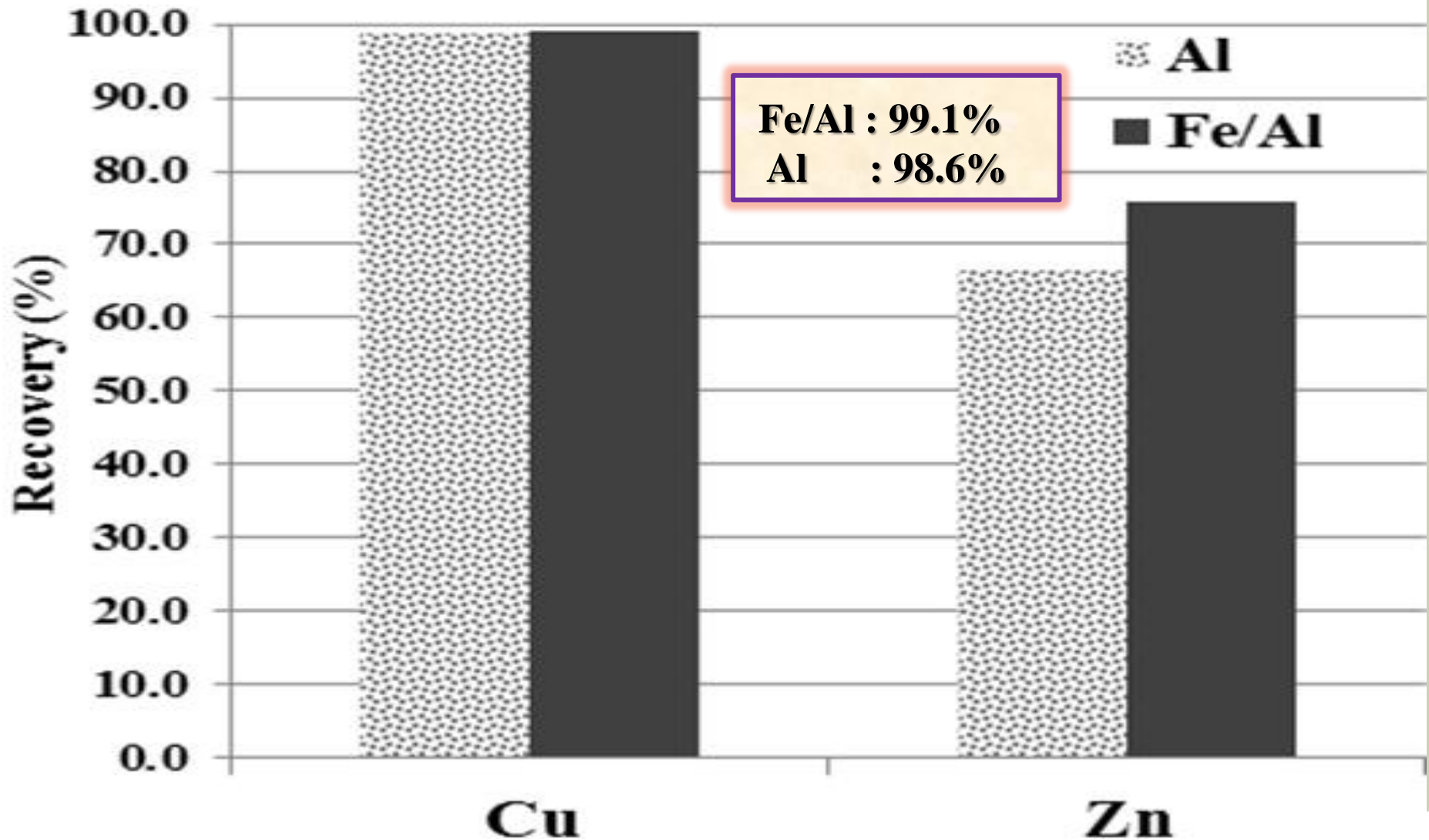
❖ 1M $\text{FeCl}_2 \cdot 4\text{H}_2\text{O}$, 1.6M NaCl and 0.04M HCl at contact time 3 hours

❖ Fe on Al surface : 7.7%

2. Cementation of copper ion using Fe/Al Co-substrate



2. Cementation of copper ion using Fe/Al Co-substrate



Conclusion

- ❖ Fe/Al Co-substrate is a substrate having both effective electron donor and magnetic property.
- ❖ The synthesized substrate provided 99.1% Cu recovery
- ❖ The series of experiments showed that iron had no significant impact on the cementation process, but easier separated due to magnetic property of Fe

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