

**Vasa , August 26<sup>th</sup> – September 1<sup>st</sup>, 2012**

# **Pyrite oxidation and inhibition by certain chemicals in relation to the problem of acidity generation in acid sulfate soils**

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**7th International Acid Sulfate Soil Conference**

**"La pyrite est à l'industrie chimique ce que le pain est à l'alimentation de l'homme"**

**P. Truchot, *Les Pyrites*, Paris, 1907**

**Pyrite oxidation: produces sulfuric acid and induces the release of metal ions causing big problems in the environment protection and agriculture.**

**Most popular solution: Liming**

**Advantages: cheap, simple, fertilizes the soil, removes metal ions, depresses the activity of acidophilic bacteria**

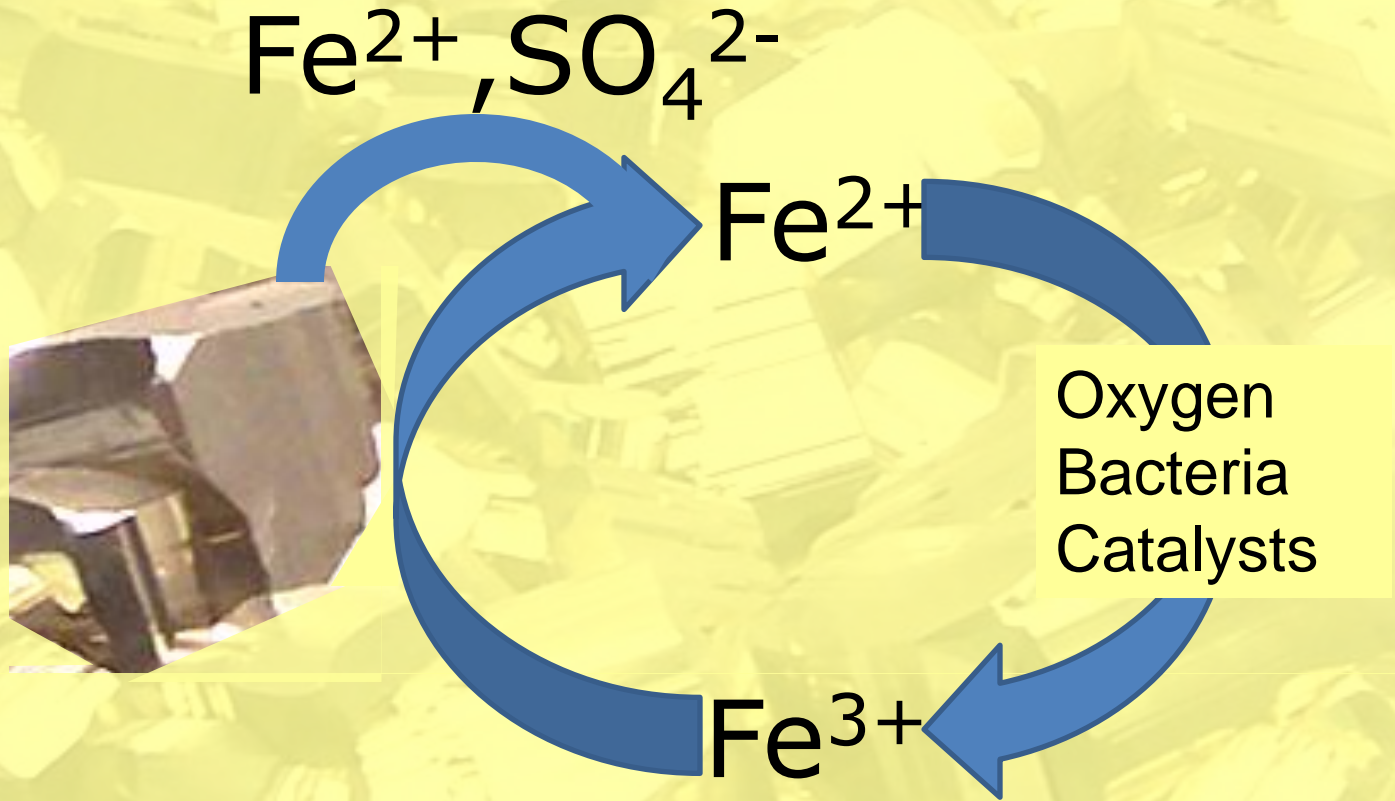


**Liming**



**Disadvantages: speeds up the oxidation of pyrite, requires large amount of reagent**

# Mechanism of pyrite oxidation

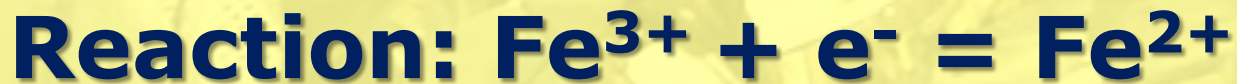


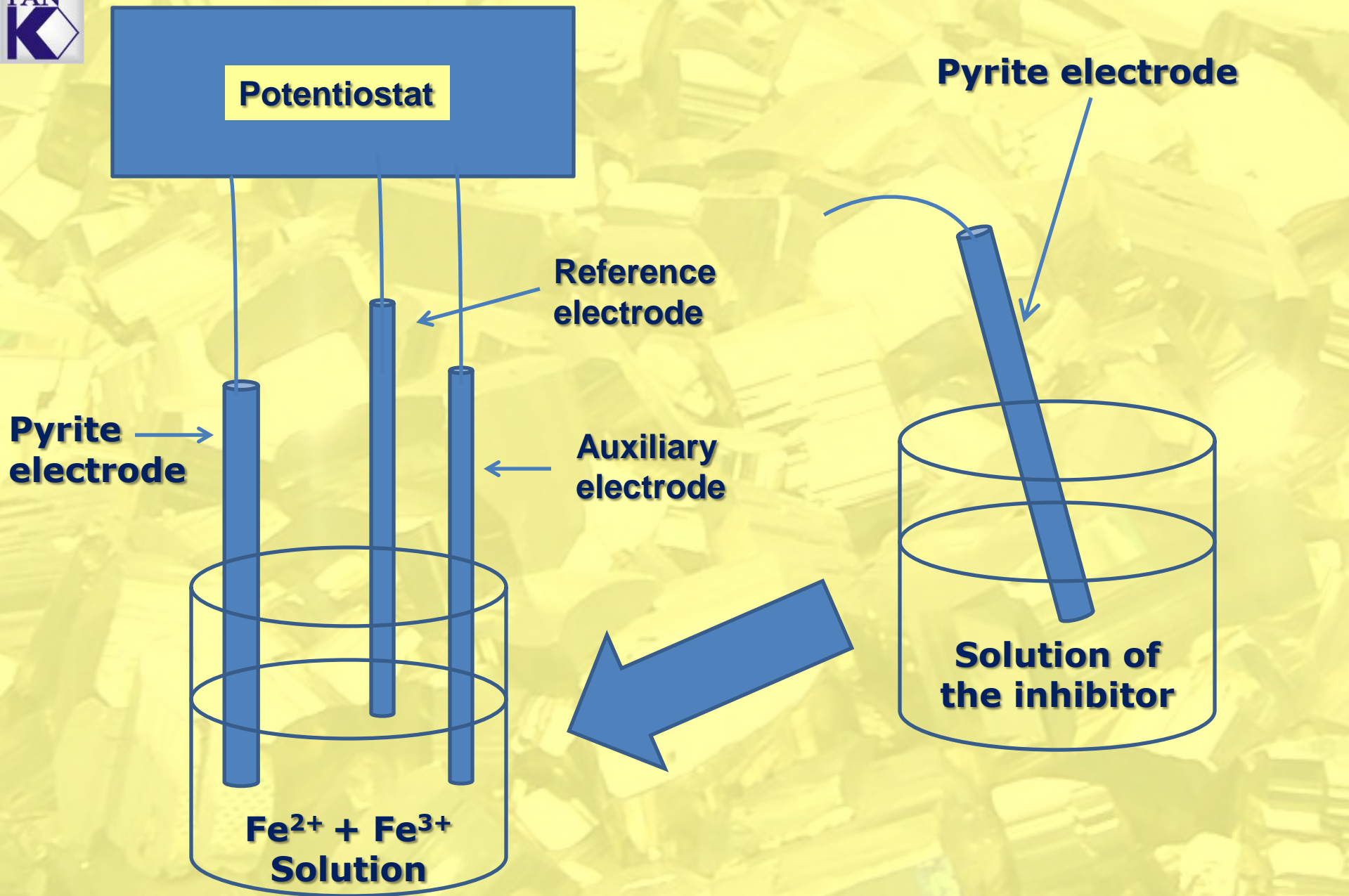
# Compounds studied

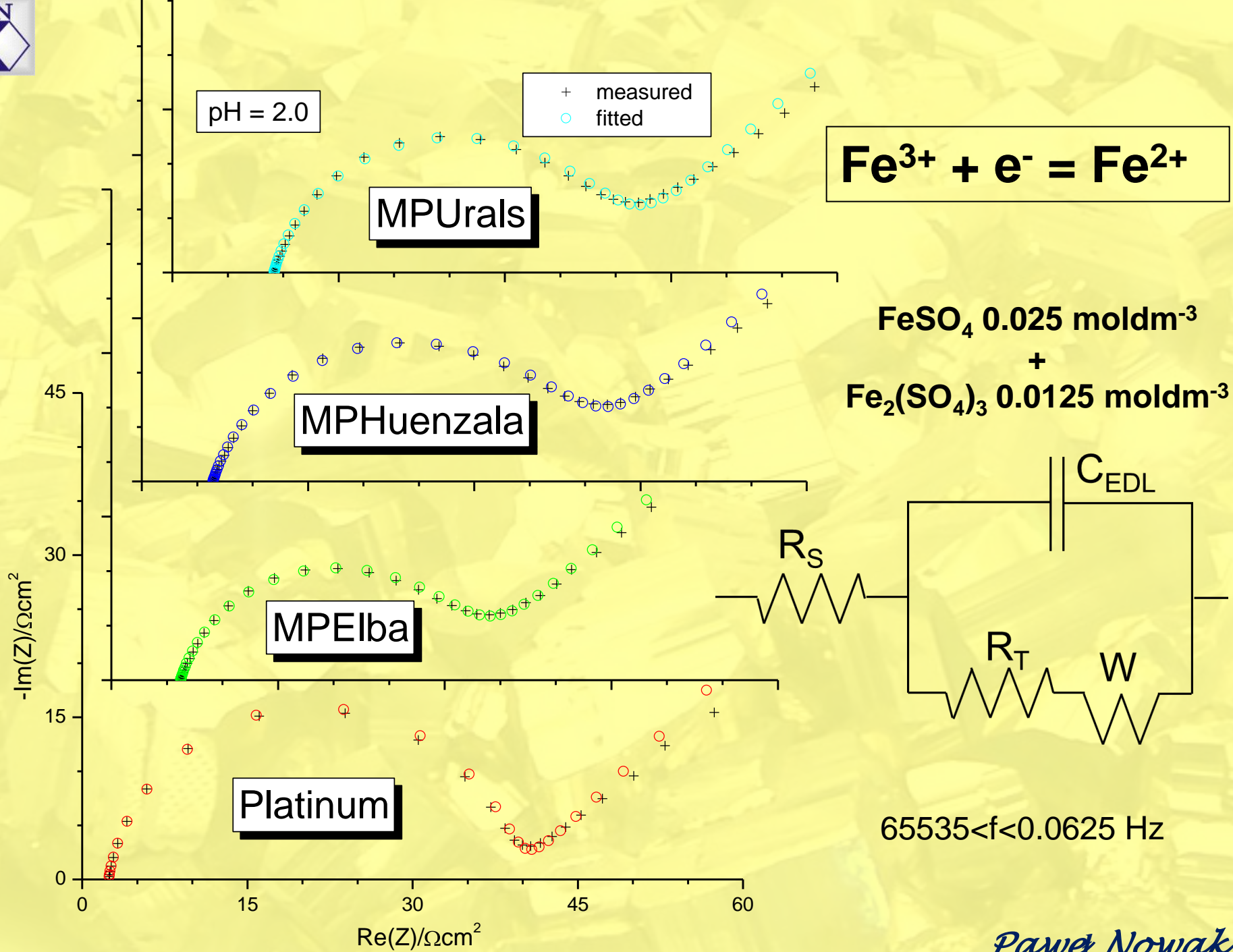
1. **n-octyl alcohol - OCT**
2. **Sodium dodecyl sulfate - DDSNa**
3. **Dodecyl trimethyl ammonium chloride - DTACl**
4. **Bis(2-ethylhexyl) phosphoric acid sodium salt – D2EHP**
5. **Sodium oleate - NaOL**
6. **2-mercaptobenzothiazole sodium salt - MBT**
7. **Humic acid sodium salt - NaHA**
8. **Phosphoric acid - PhA**

# Measurements performed

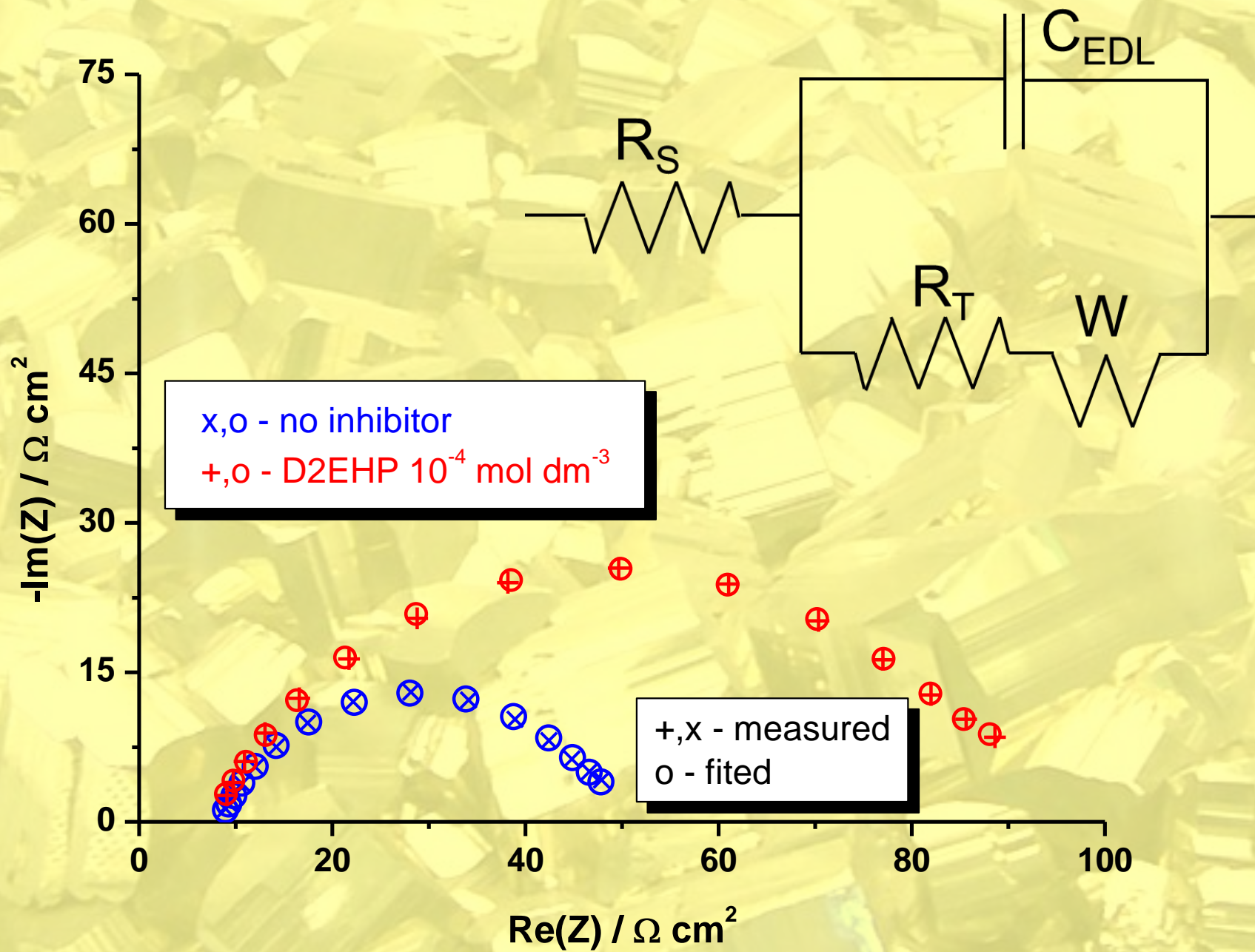
**Capacitance of the electrical double layer and charge transfer resistance at the pyrite / aqueous solution interface in the equimolar solution of  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$**

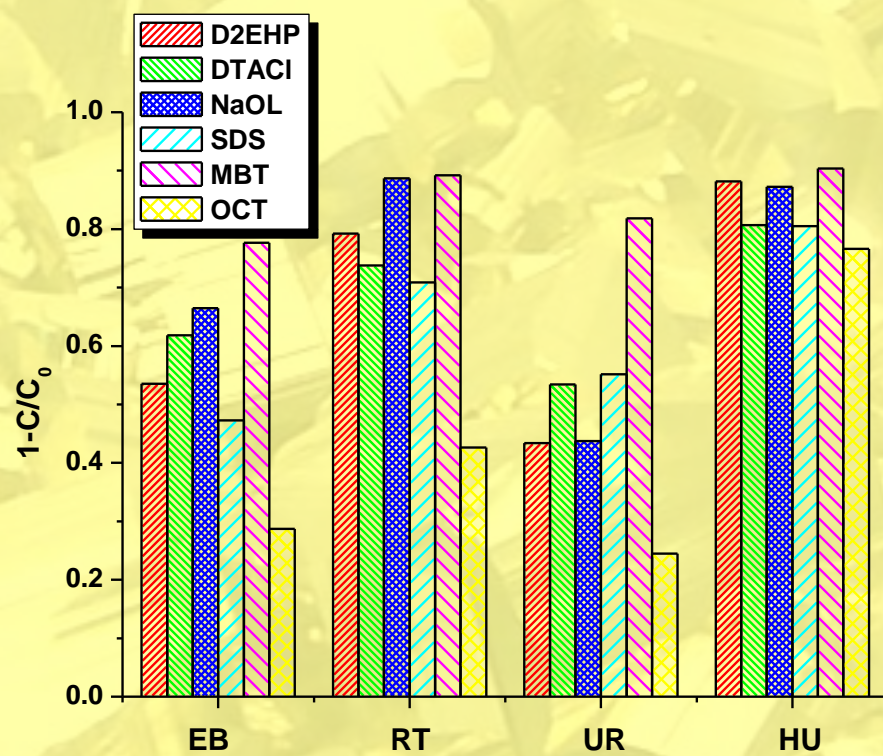
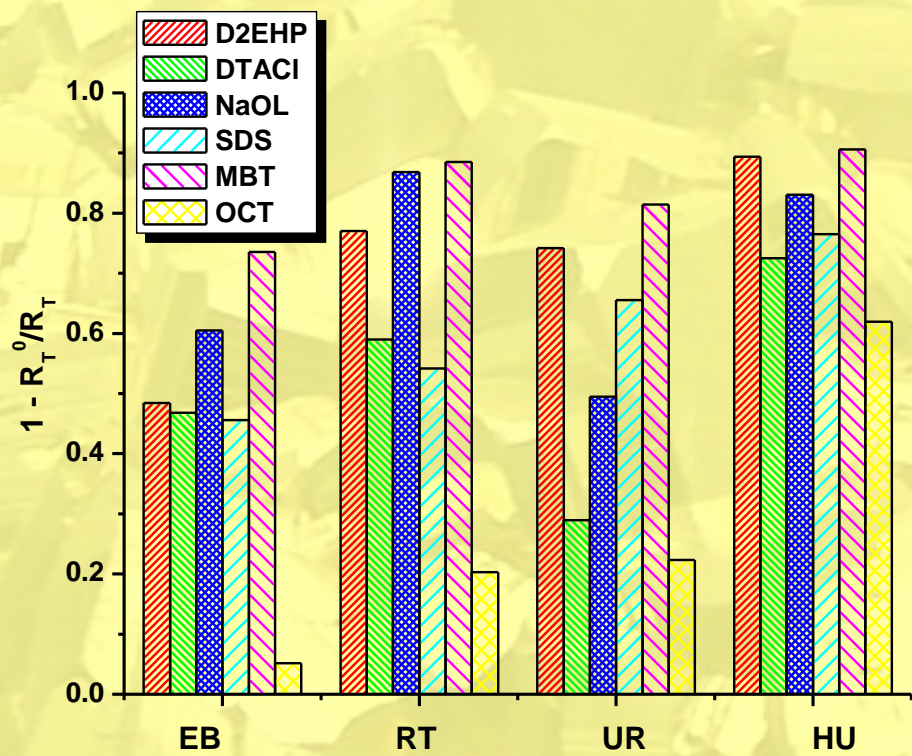








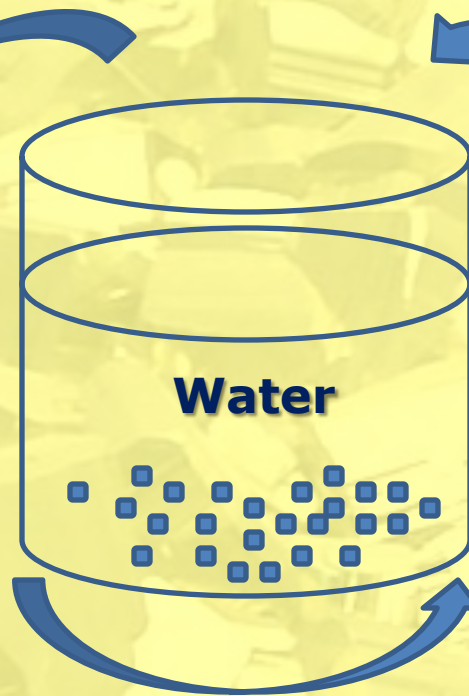




**Analysis for  
released  $\text{Fe}^{3+}$**

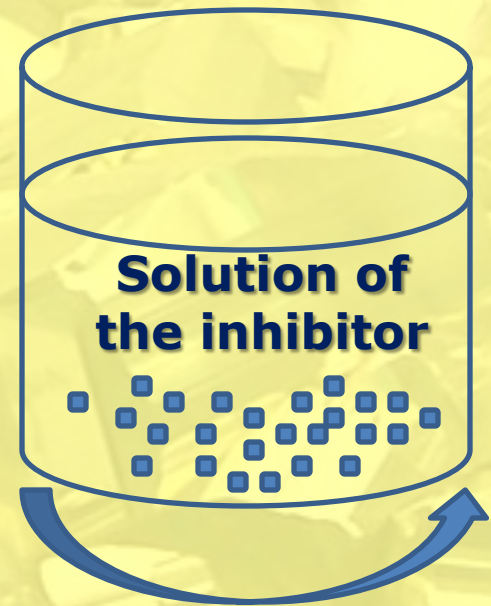


**Stirring with  
magnetic stirrer**



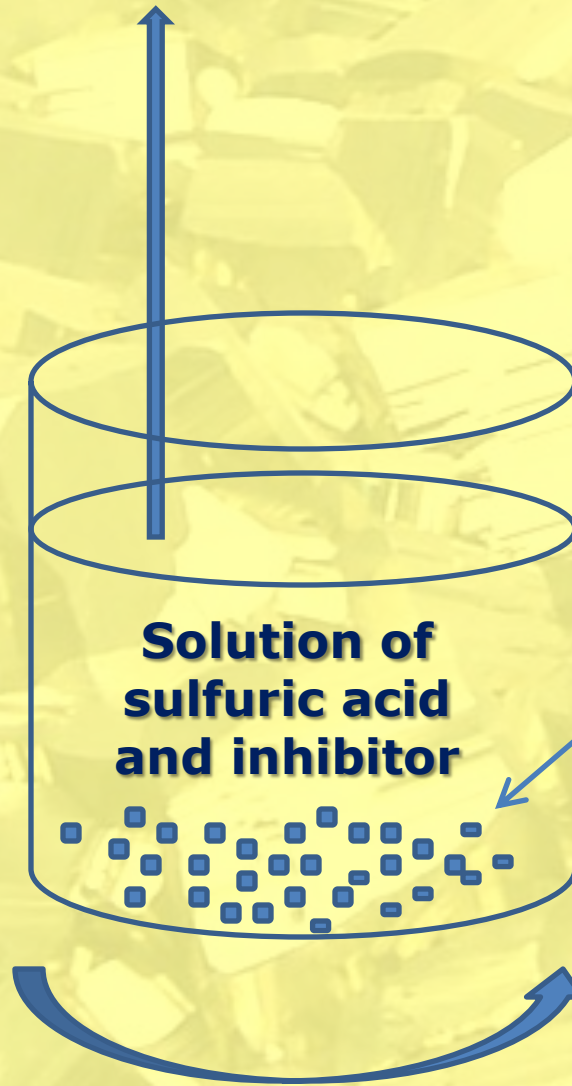
**Stirring with  
magnetic stirrer**

**1 g of pyrite  
grains**



**Stirring with  
magnetic stirrer**

**Analysis for  
released  $\text{Fe}^{3+}$**



**Solution of  
sulfuric acid  
and inhibitor**

**0.5 g of pyrite  
grains**

**Stirring with magnetic stirrer**

**Conditioning: 1 g of pyrite, 250 cm<sup>3</sup> solution of inhibitor, 30 minutes of stirring with magnetic stirrer, room temperature**

**Leaching: 5X10<sup>-3</sup> mol dm<sup>-3</sup> sulfuric acid, 24 hours of stirring with magnetic stirrer, room temperature**

<b>Inhibitor</b>	<b>Concentration of Fe<sup>3+</sup> leached / mg dm<sup>-3</sup></b>	<b>Relative to reference / %</b>
<b>No inhibitor (reference)</b>	<b>31.7</b>	<b>-</b>
<b>2-mercaptobenzothiazole sodium salt</b>	<b>12.1</b>	<b>38</b>
<b>Sodium oleate</b>	<b>16.9</b>	<b>53</b>
<b>Bis(2-ethylhexyl) phosphoric acid sodium salt</b>	<b>17.2</b>	<b>54</b>

**Leaching of pyrite at the presence of the inhibitor:  $5 \times 10^{-2}$  mol dm<sup>-3</sup> sulfuric acid, 7 days of stirring with magnetic stirrer, room temperature**

<b>Inhibitor</b>	<b>Time days</b>	<b>Concentration of Fe<sup>3+</sup> leached mg dm<sup>-3</sup></b>	<b>Relative to reference %</b>
<b>No inhibitor (reference)</b>	<b>1</b>	<b>82.6</b>	<b>-</b>
	<b>7</b>	<b>170</b>	<b>-</b>
<b>2-mercaptobenzothiazole sodium salt, <math>5 \times 10^{-4}</math> mol dm<sup>-3</sup></b>	<b>1</b>	<b>69.8</b>	<b>84.4</b>
	<b>7</b>	<b>135.7</b>	<b>79.7</b>
<b>Humic acid sodium salt 25 mg dm<sup>-3</sup></b>	<b>1</b>	<b>76.0</b>	<b>92.0</b>
	<b>7</b>	<b>123.42</b>	<b>72.4</b>

## **Conclusions:**

**Oxidation of pyrite may be effectively suppressed using properly selected inhibitors**

**From the point of view of the use in agriculture two inhibitors might be recommended:**

**Sodium oleate**

**Humic substances**

**Thank**

**you**

**for**

**your**

**attention**