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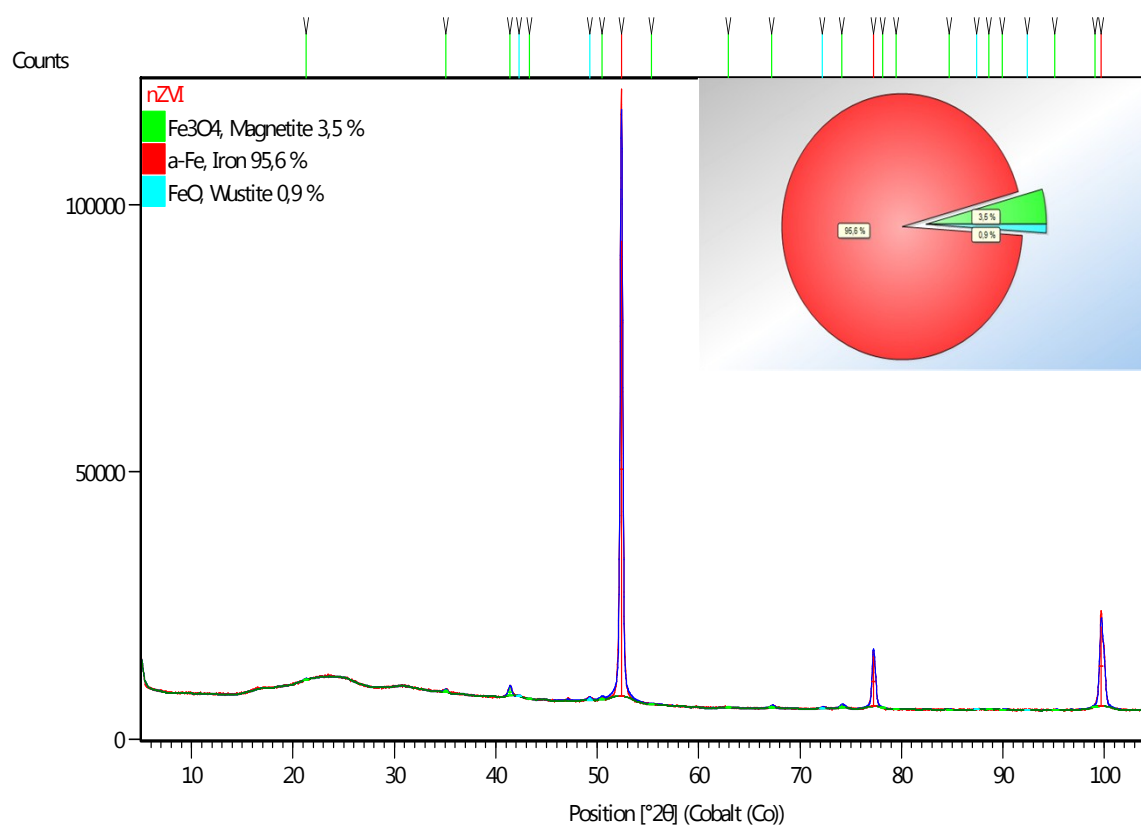
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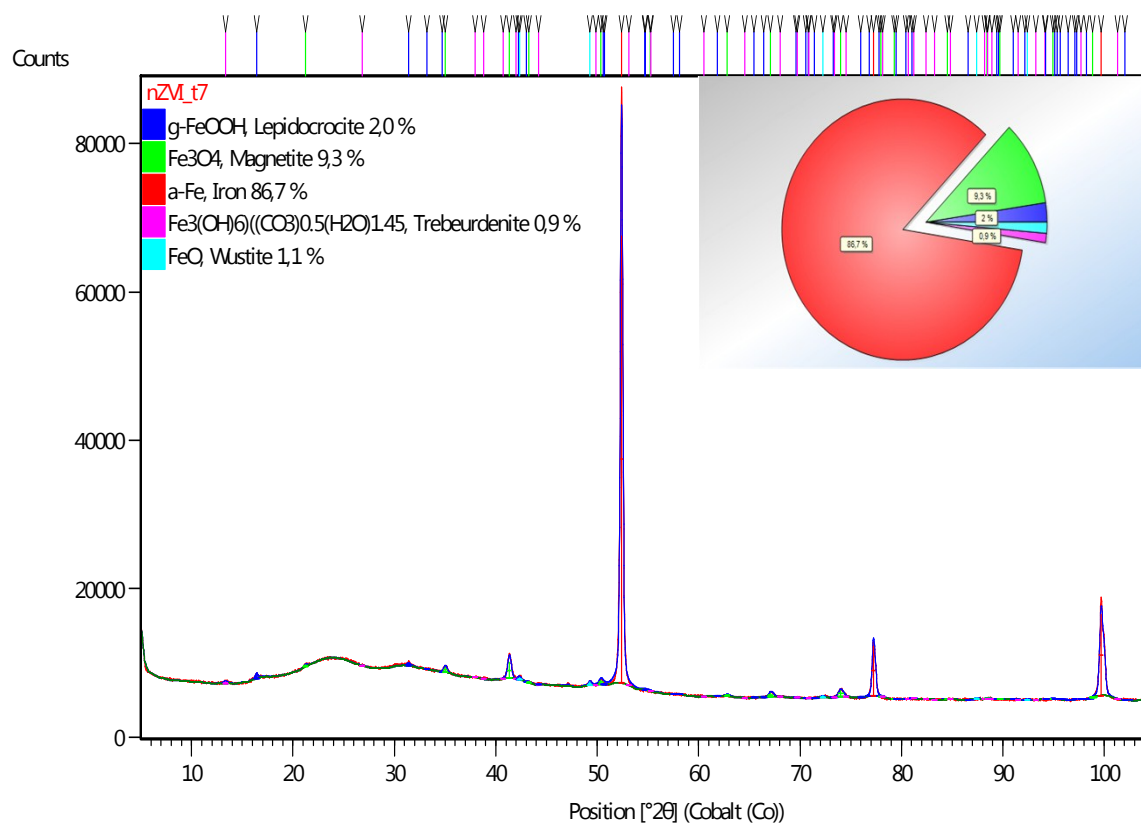
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Table S1: Quantitative phase analysis of XRD measurements

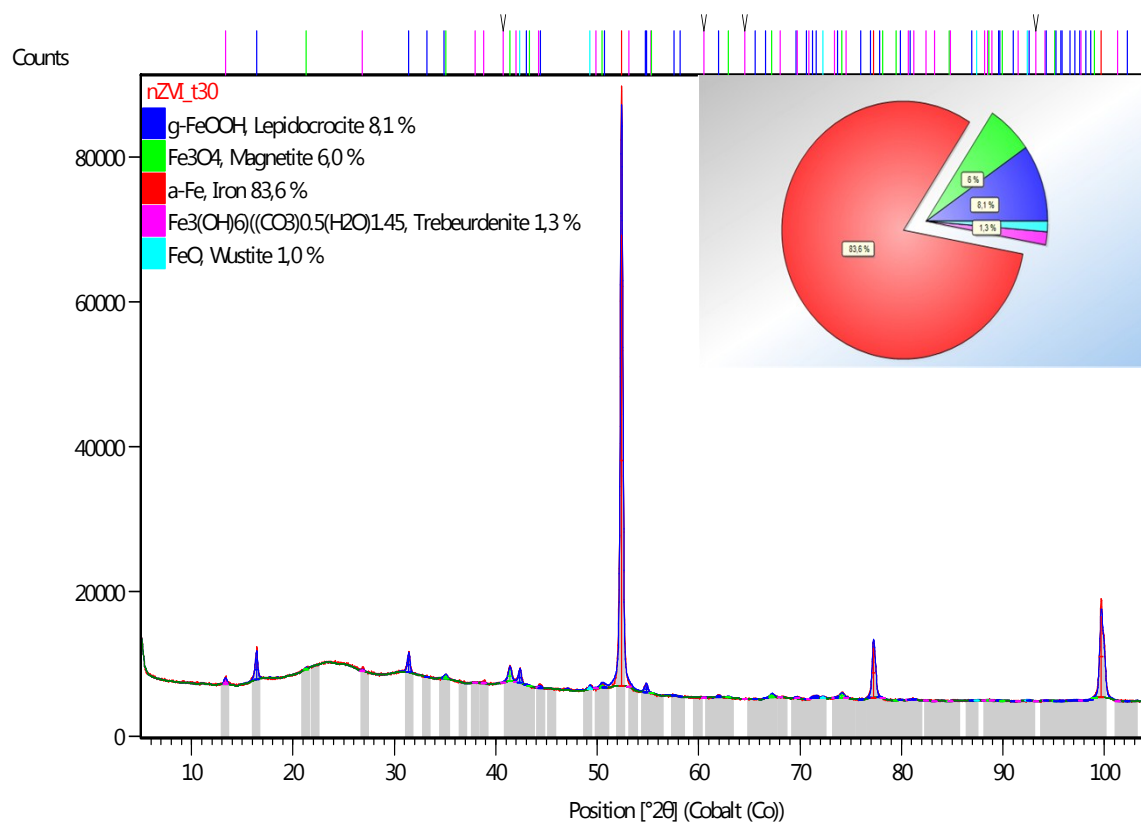
**nZVI: freshly prepared**



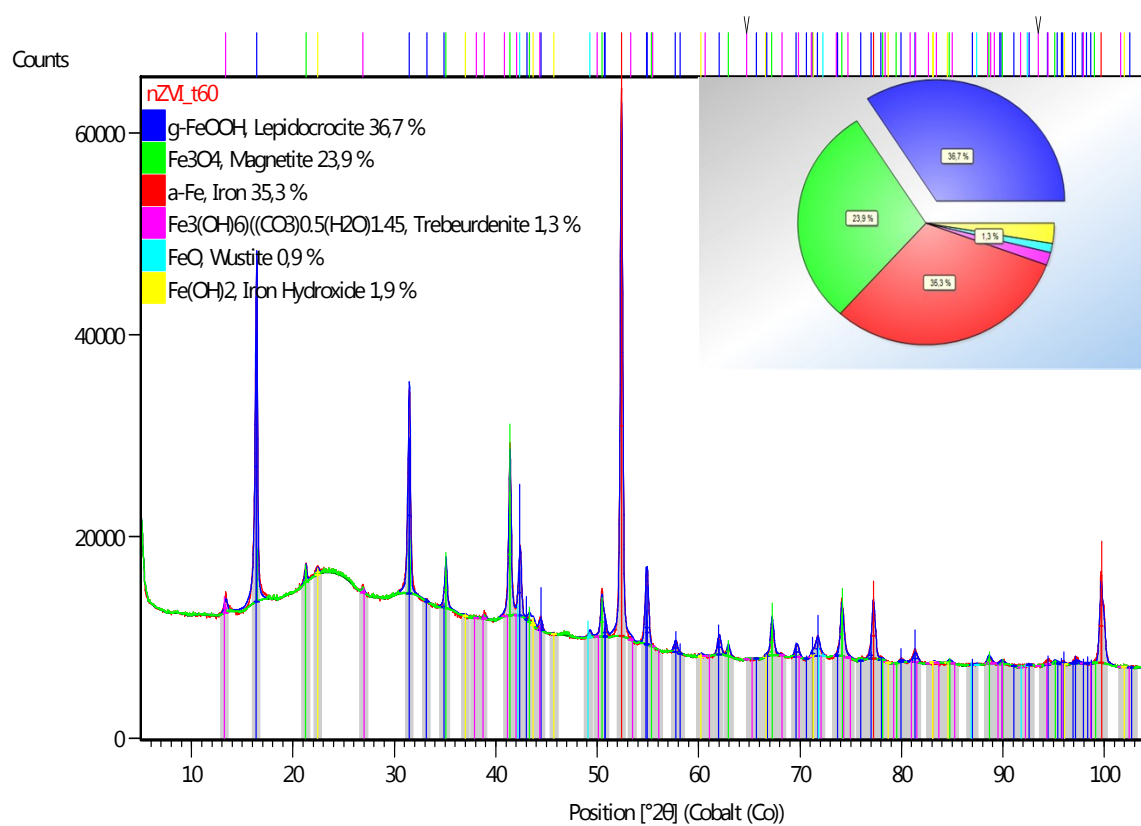
**nZVI: aged 7 days**



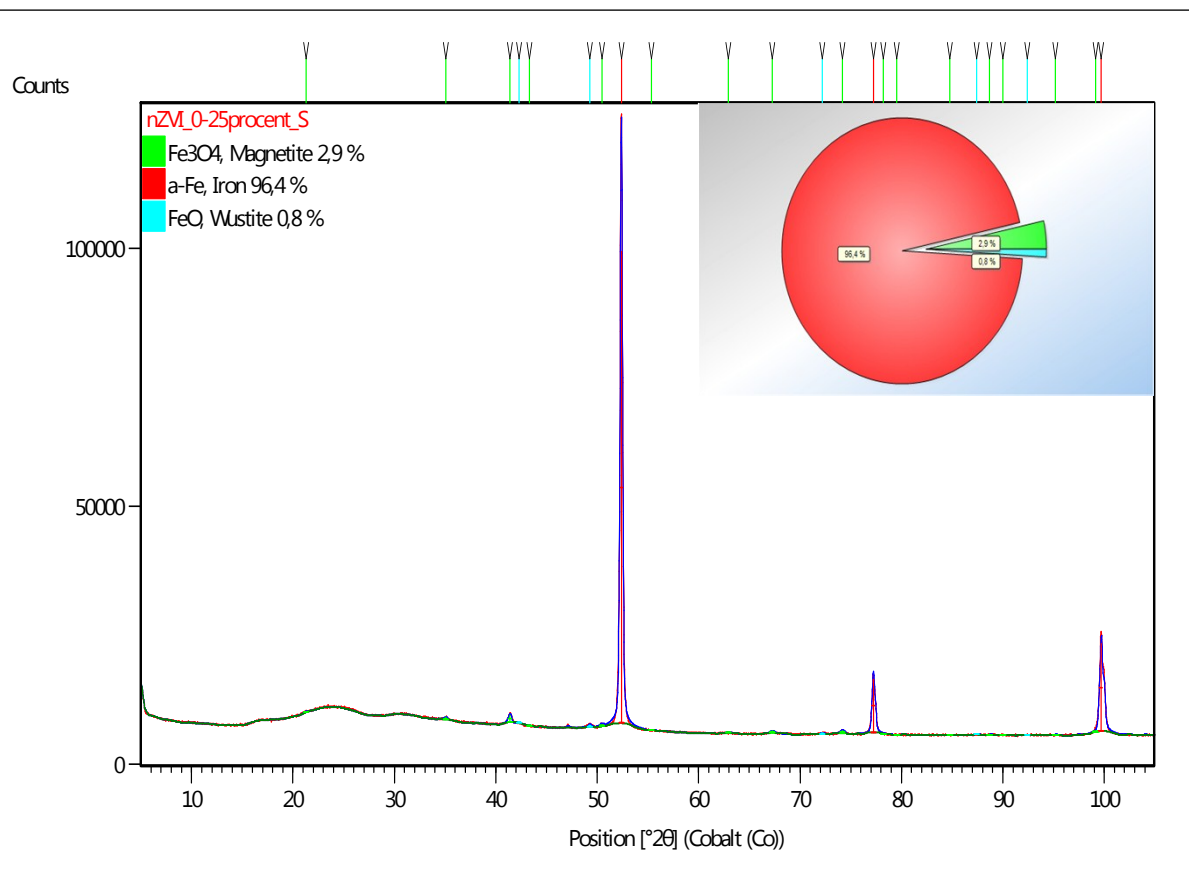
### nZVI: aged 30 days



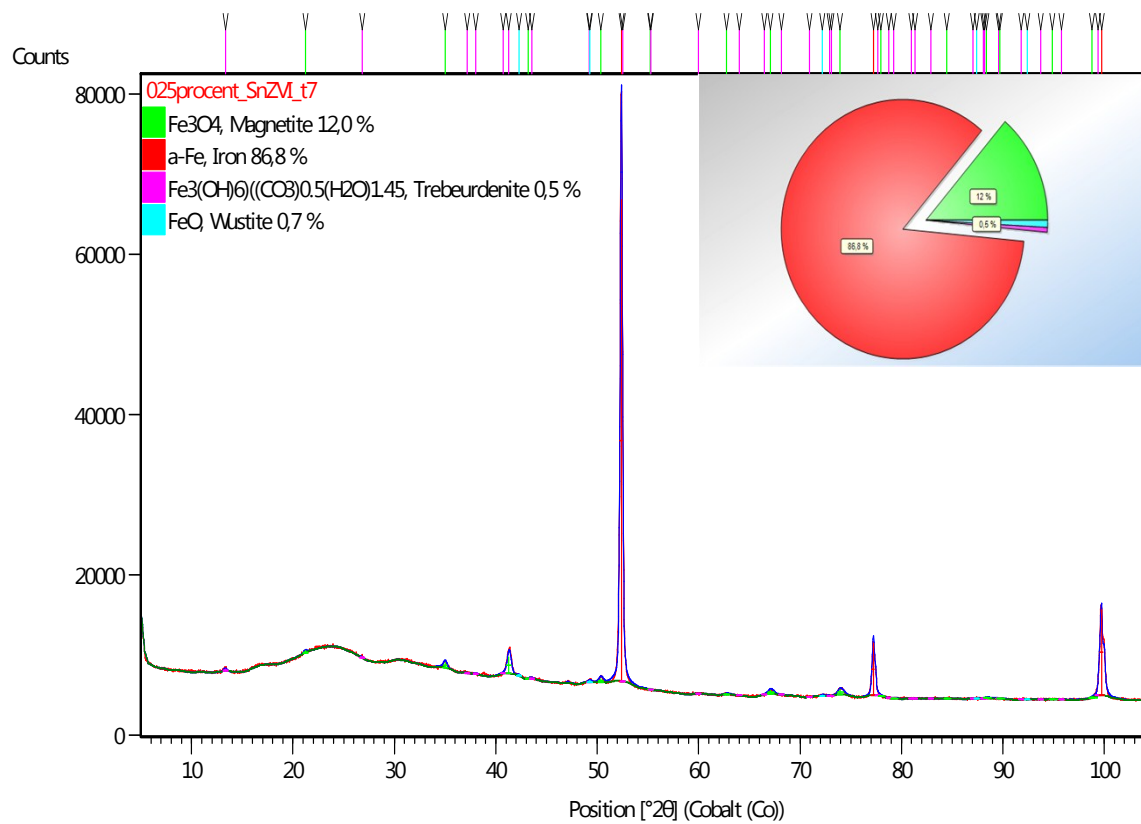
### nZVI: aged 60 days



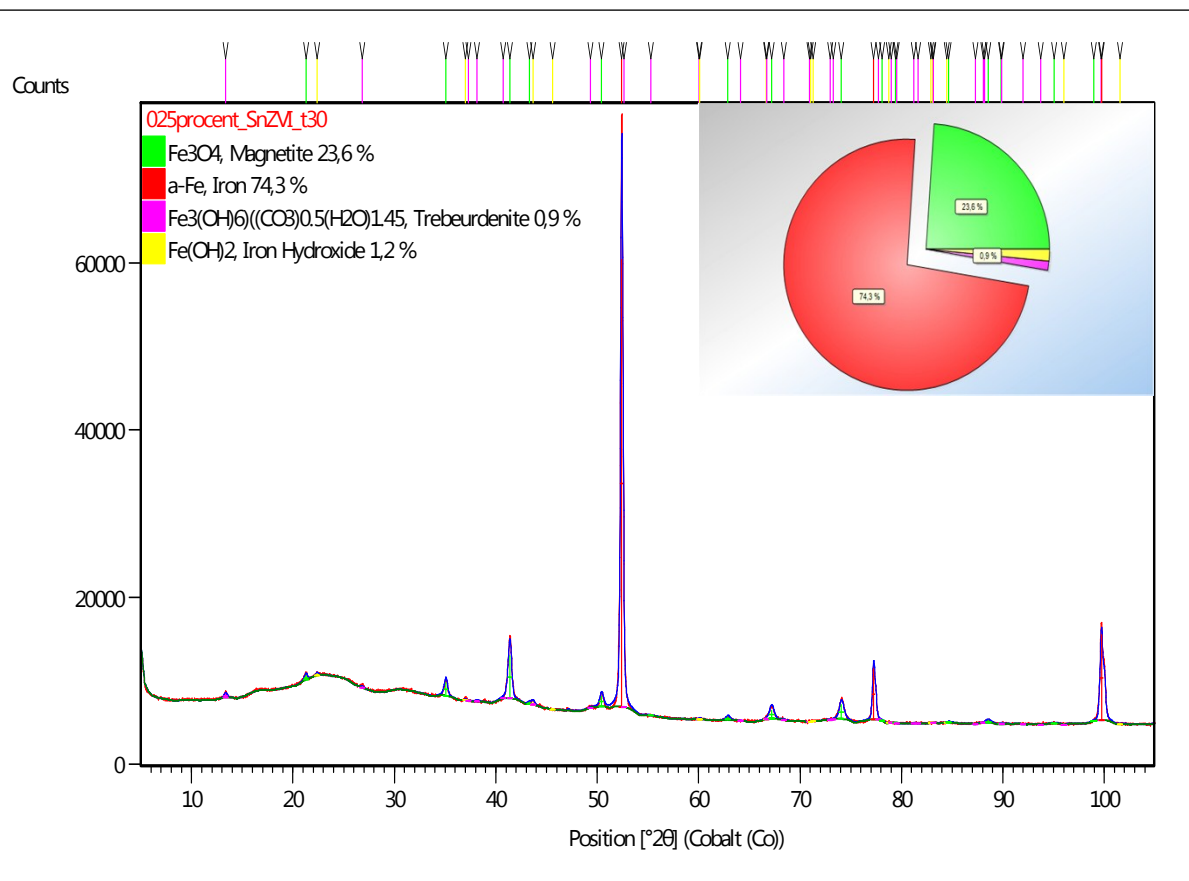
### 0.25% S-nZVI: freshly prepared



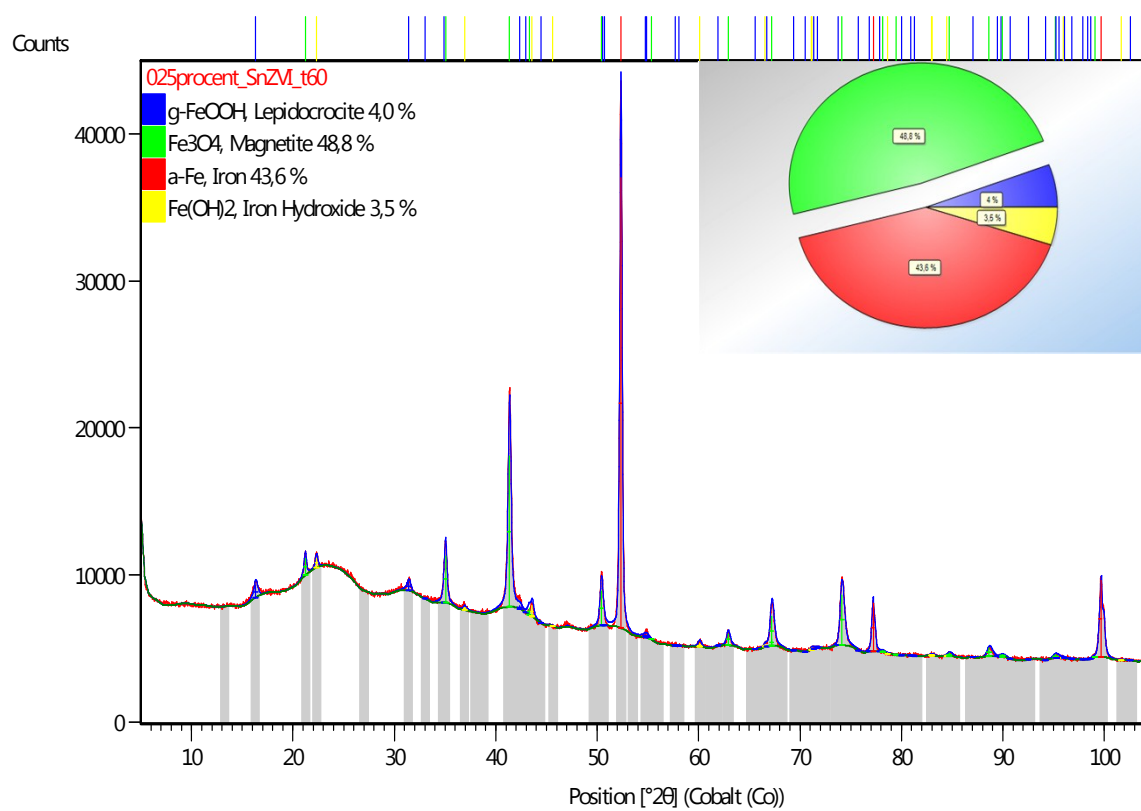
#### 0.25% S-nZVI: aged 7 days



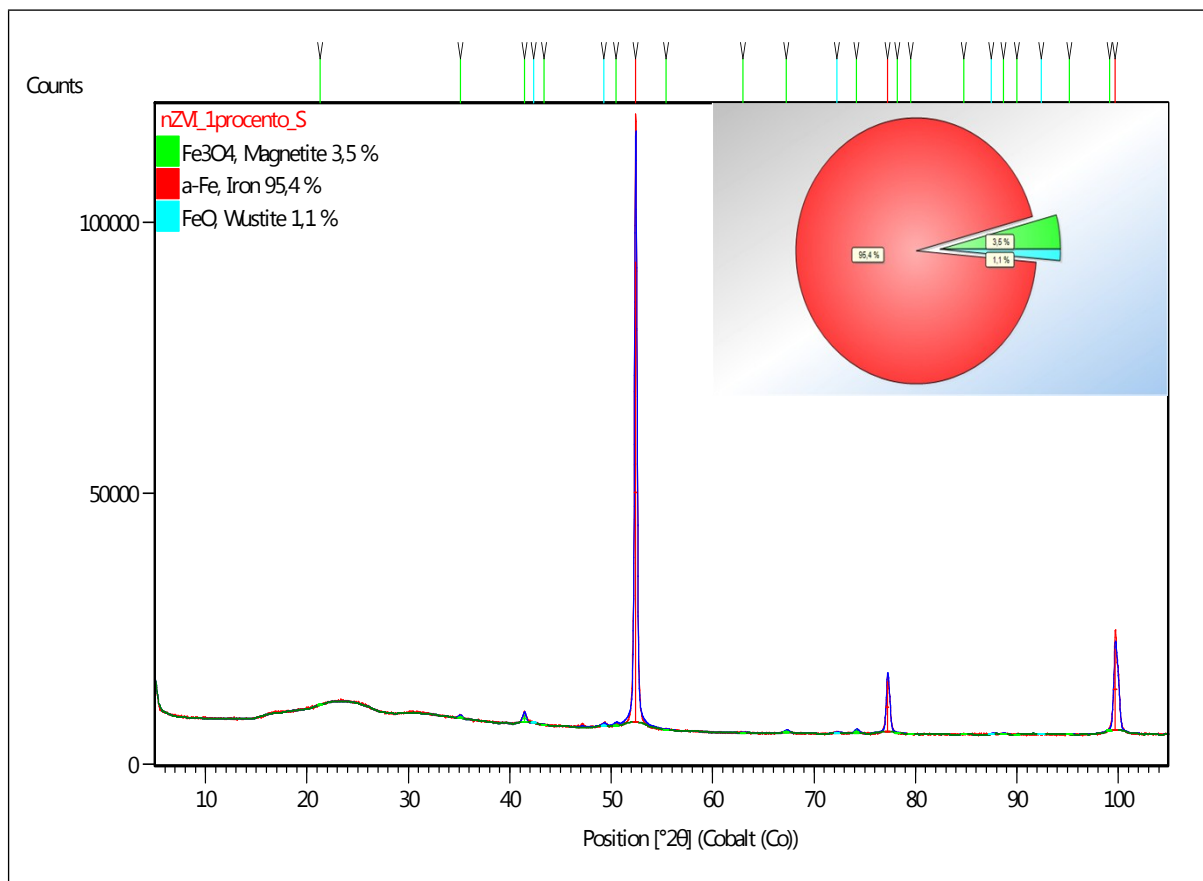
#### 0.25% S-nZVI: aged 30 days



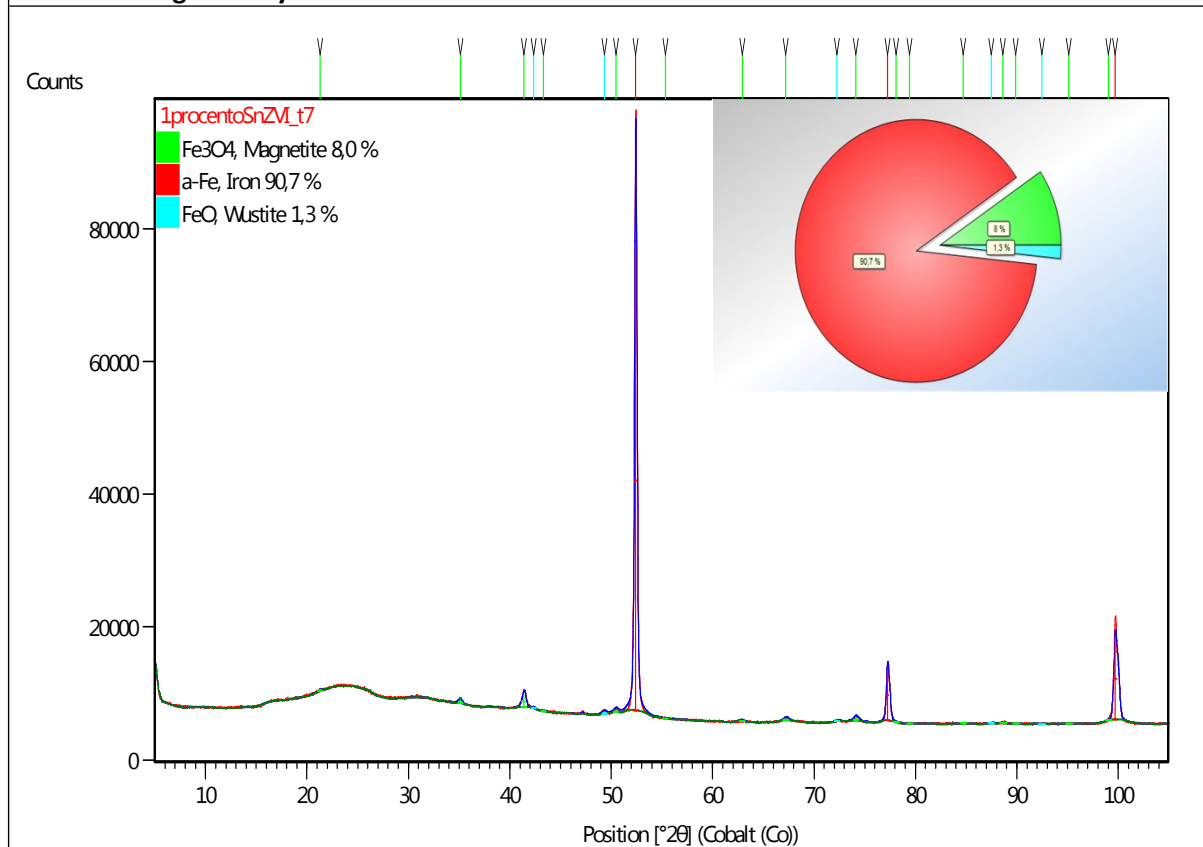
#### 0.25% S-nZVI: aged 60 days



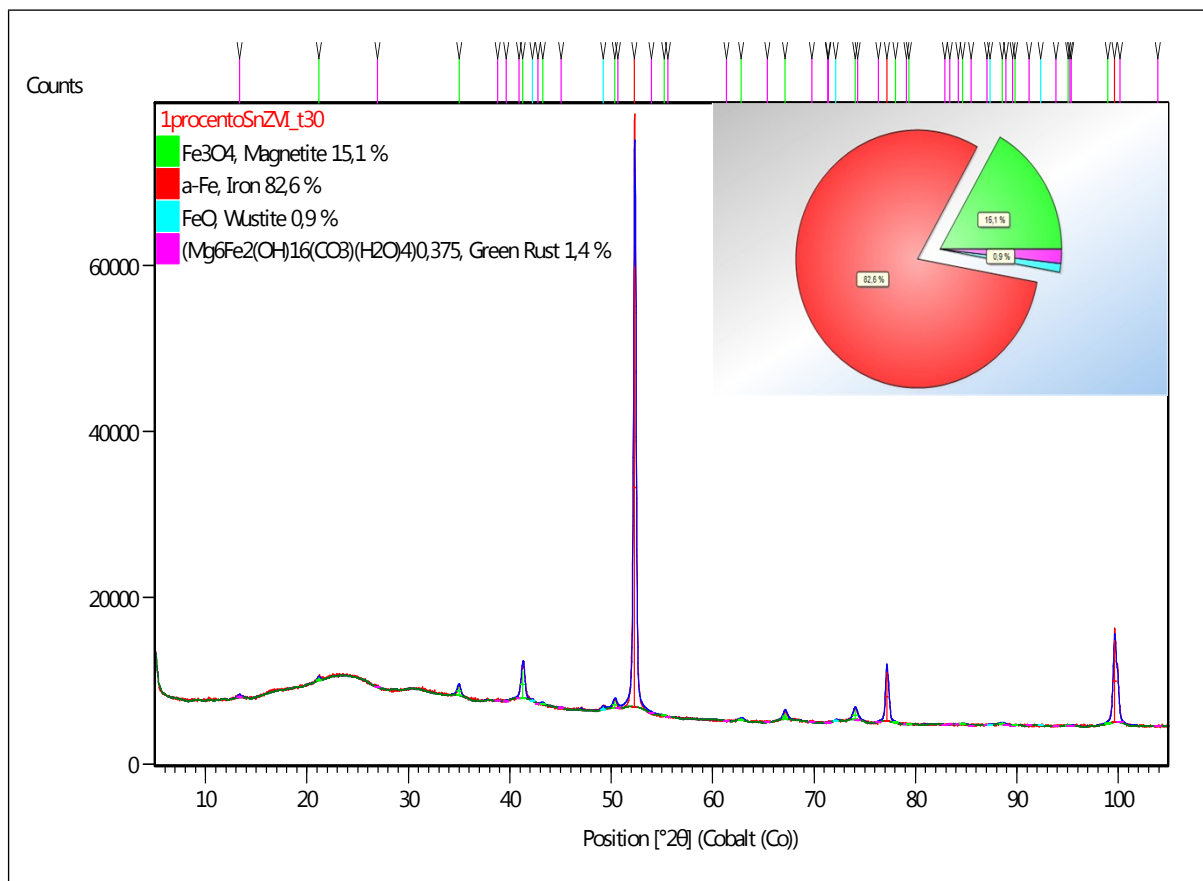
#### 1% S-nZVI: freshly prepared



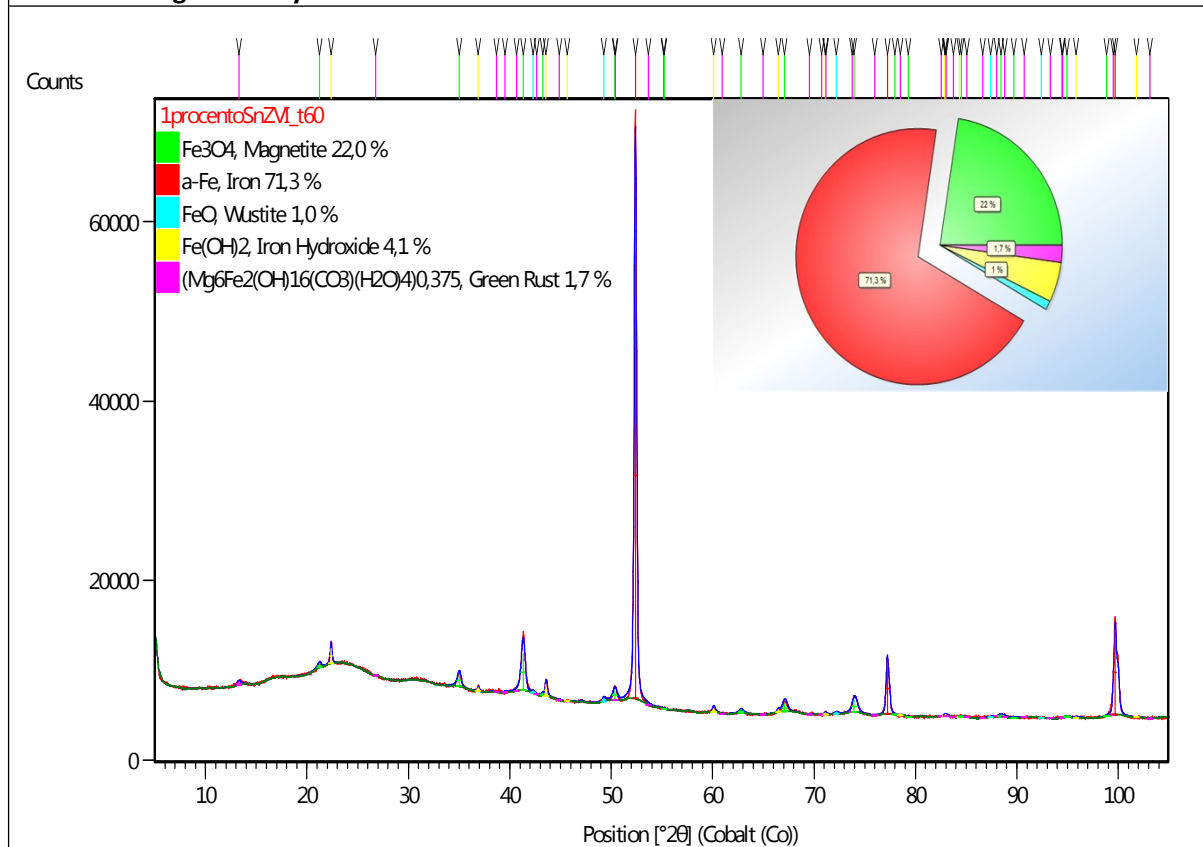
#### 1% S-nZVI: aged 7 days



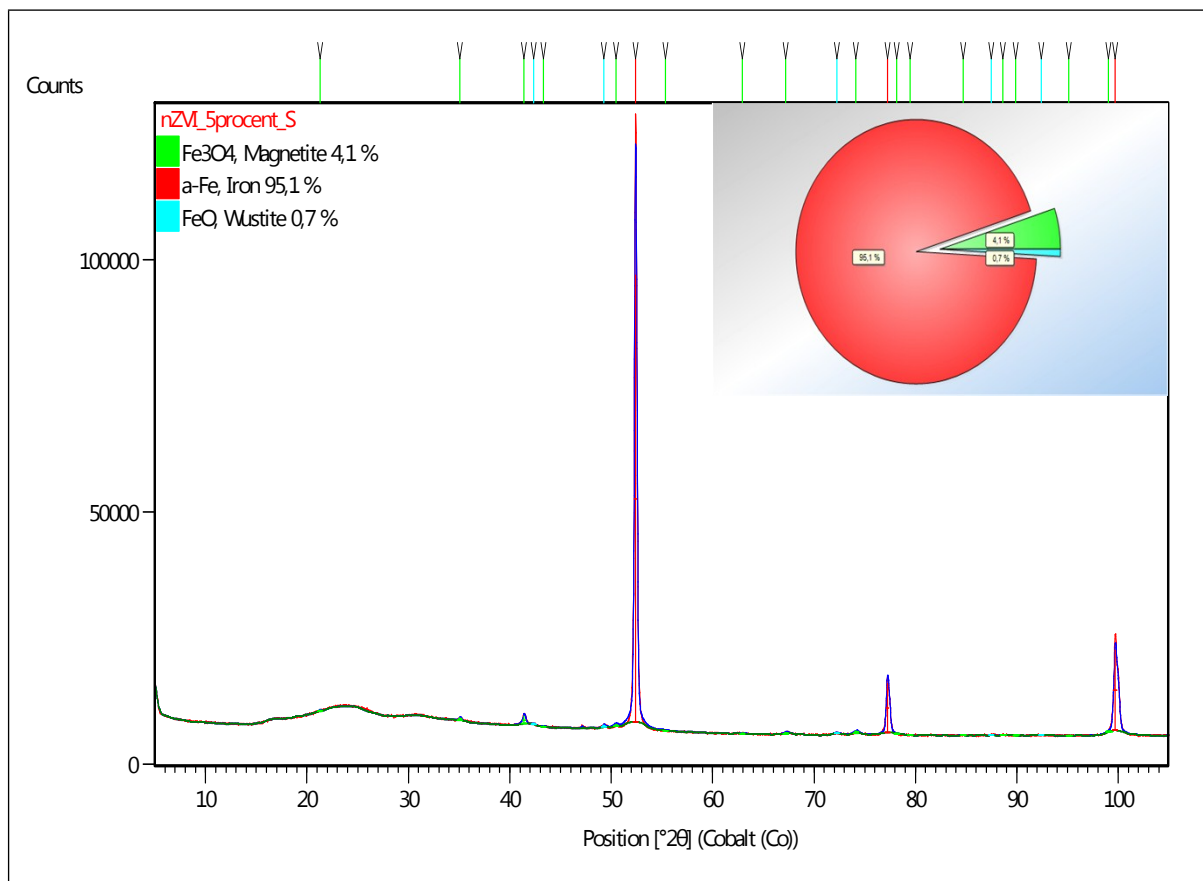
#### 1% S-nZVI: aged 30 days



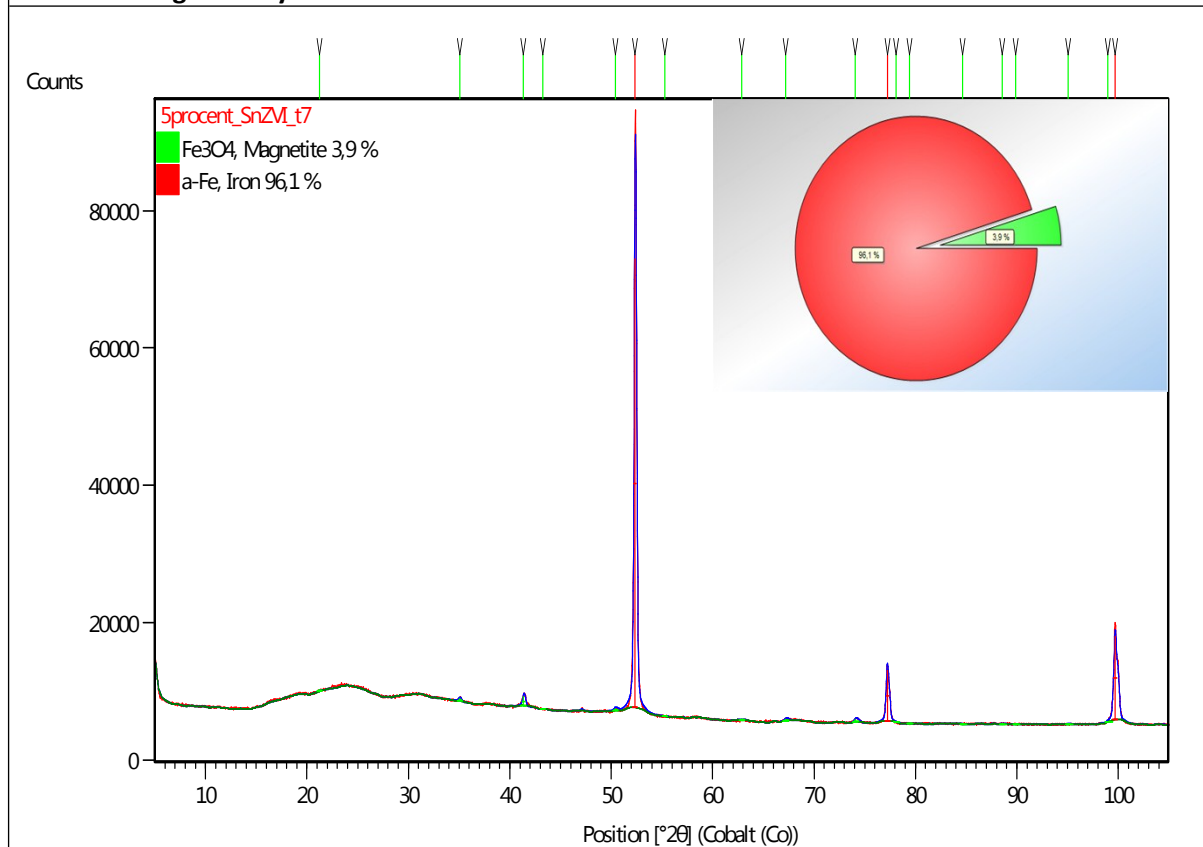
#### 1% S-nZVI: aged 60 days



#### 5% S-nZVI: freshly prepared

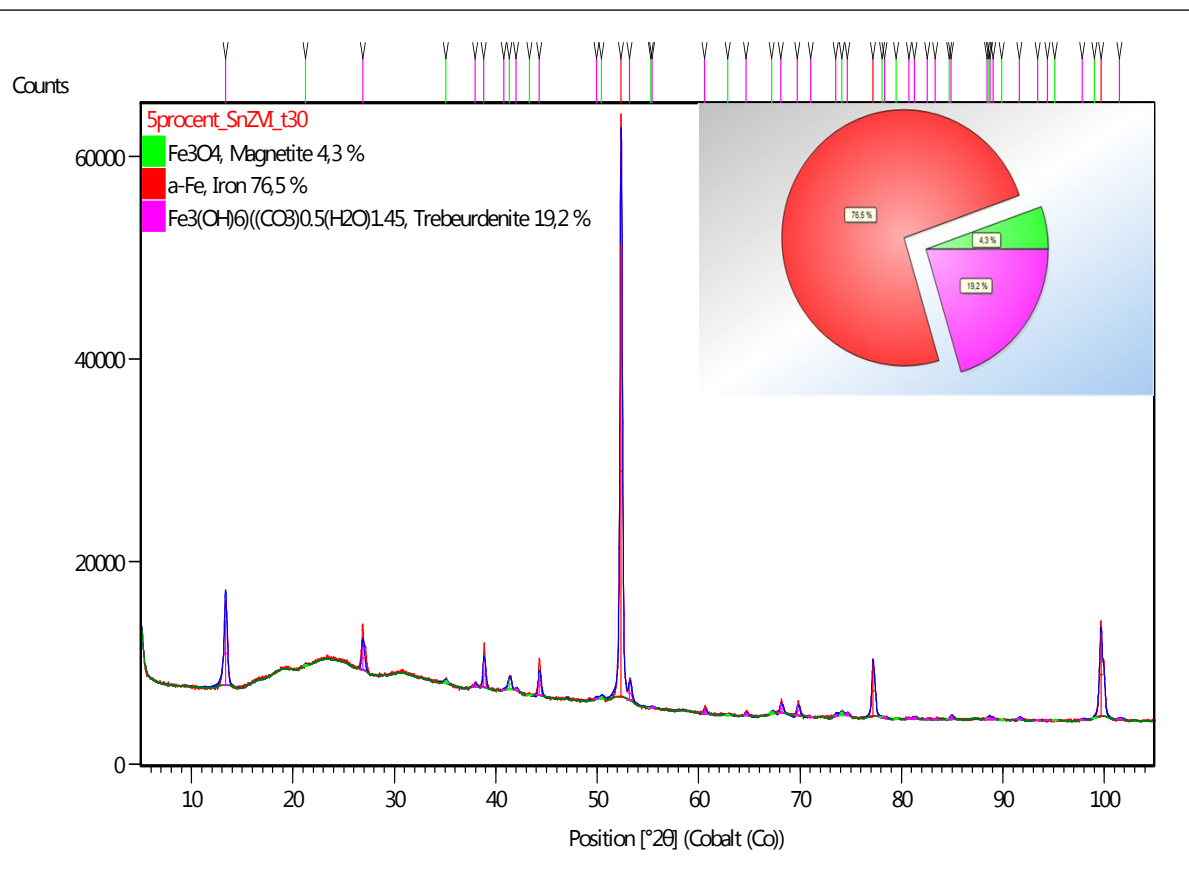


**5% S-nZVI: aged 7 days**

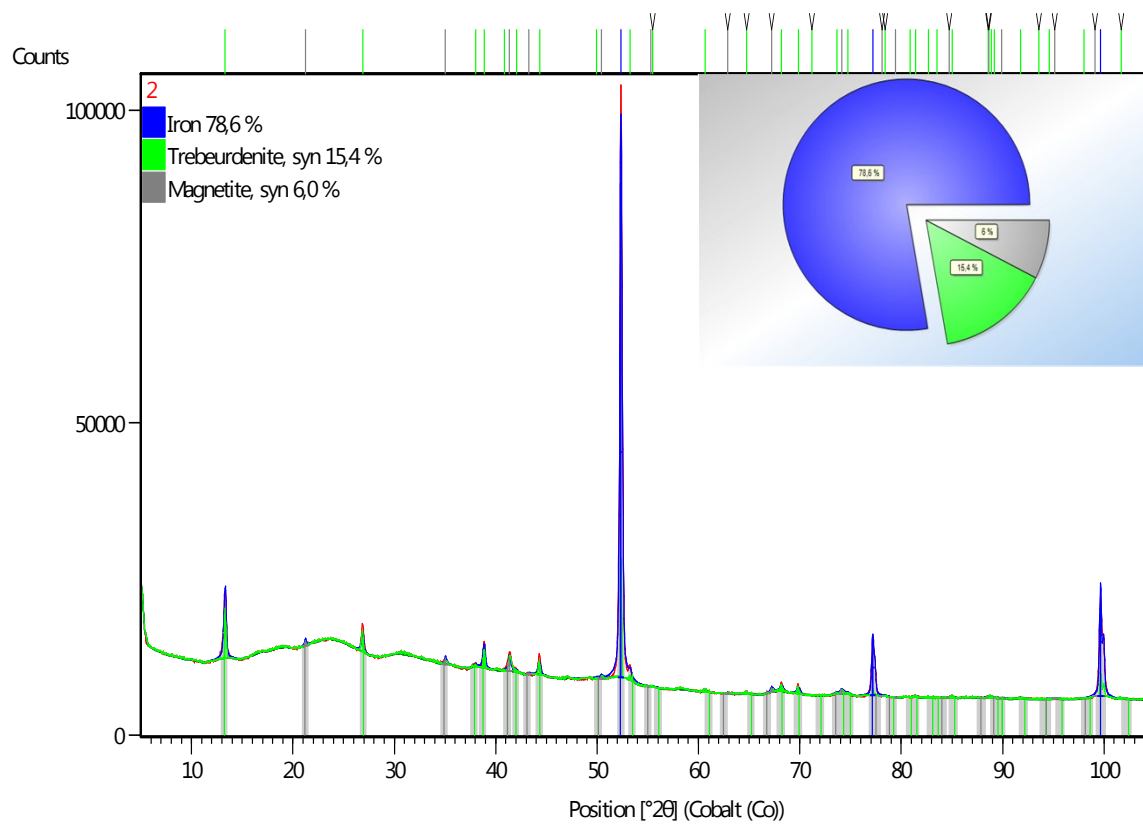


**5% S-nZVI: aged 30 days**

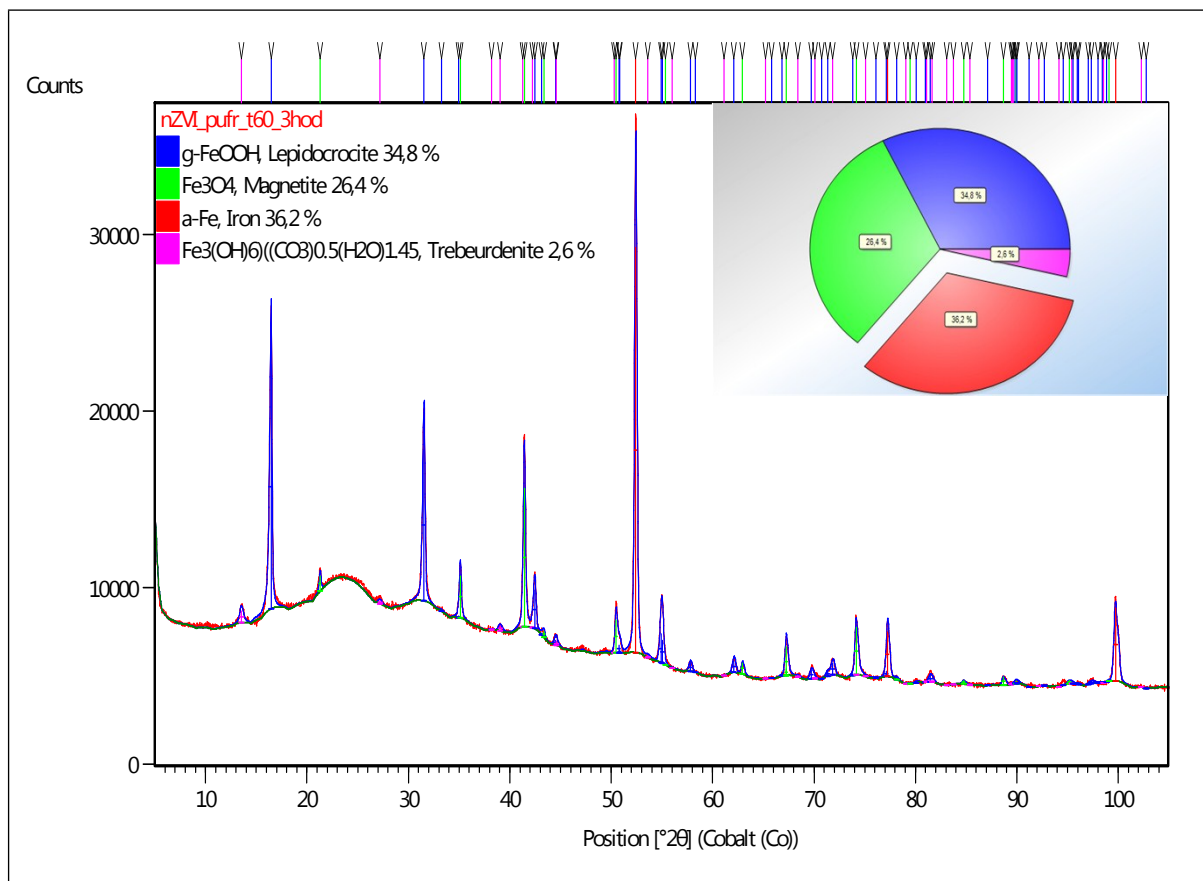




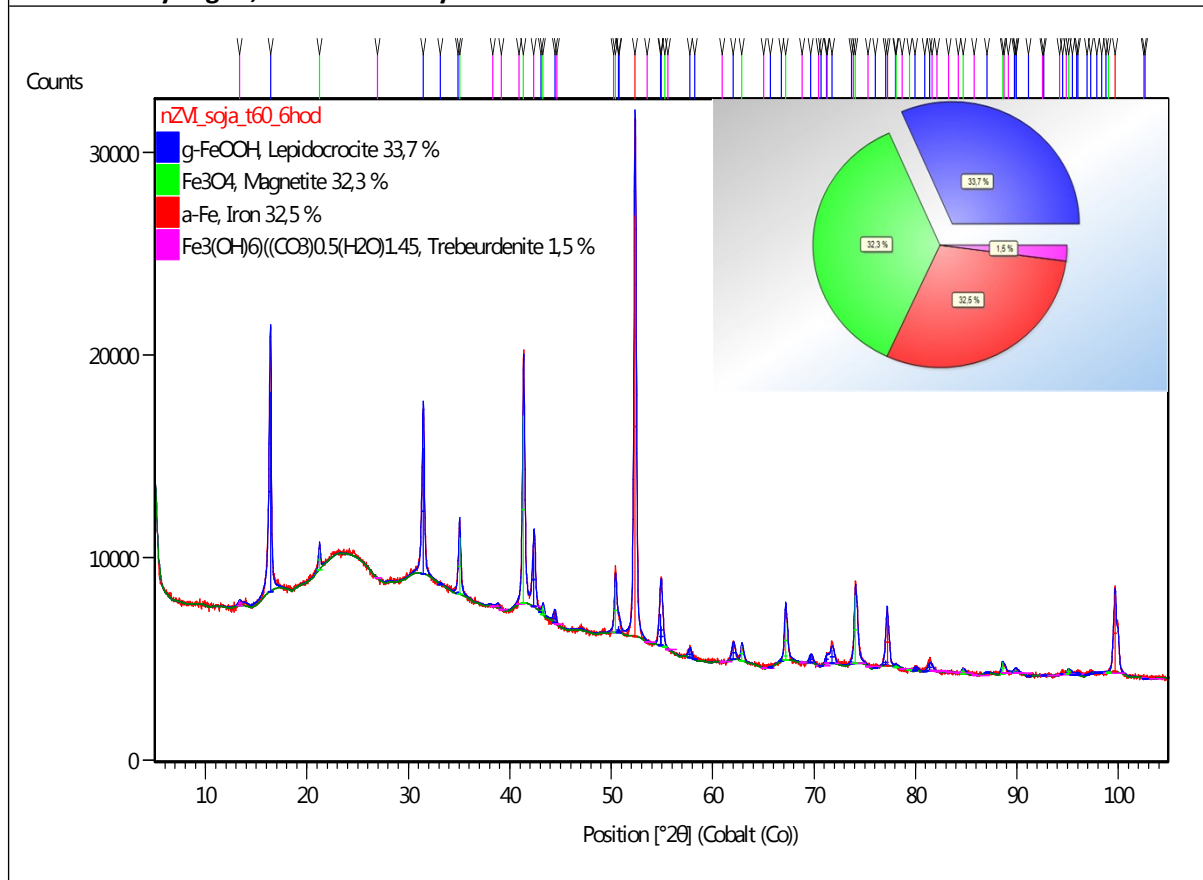
#### 5% S-nZVI: aged 60 days



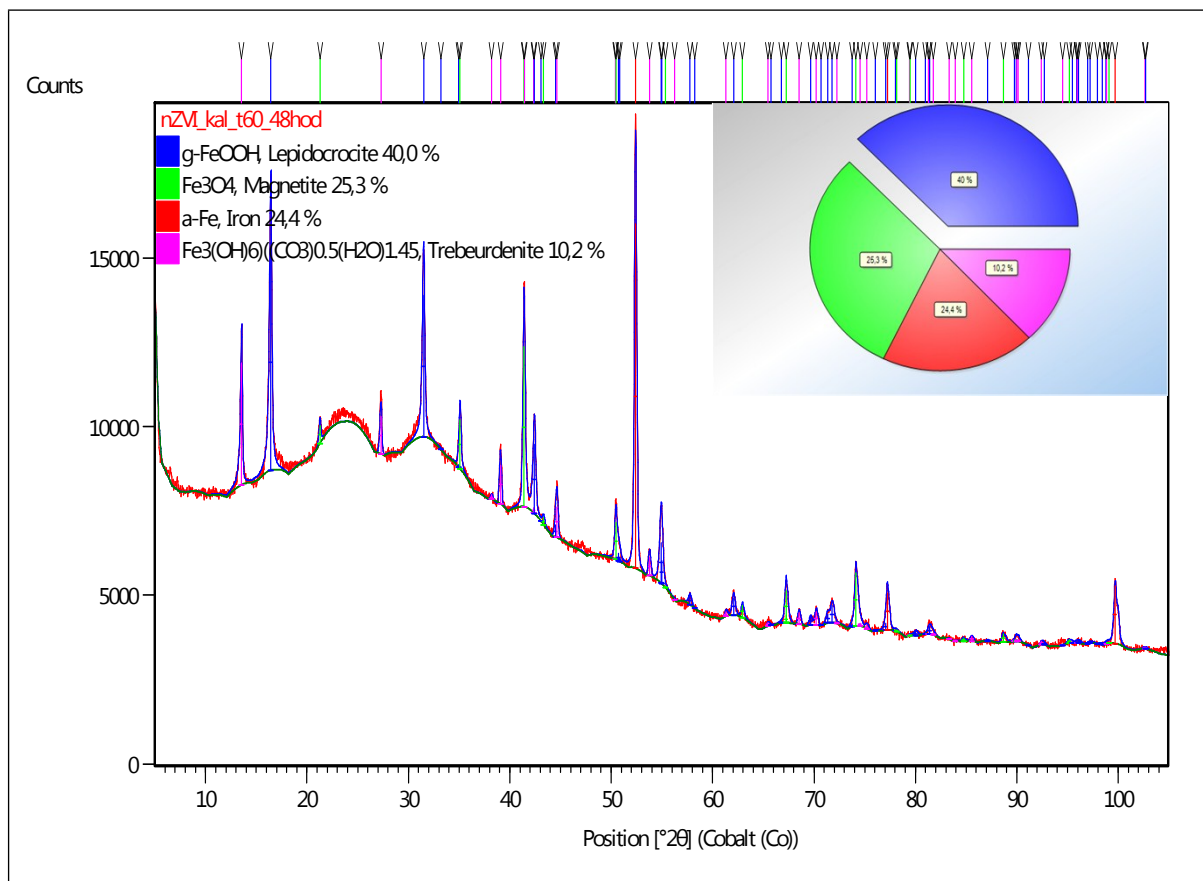
#### nZVI: 60 days aged; 3 hours in Carbonate buffer



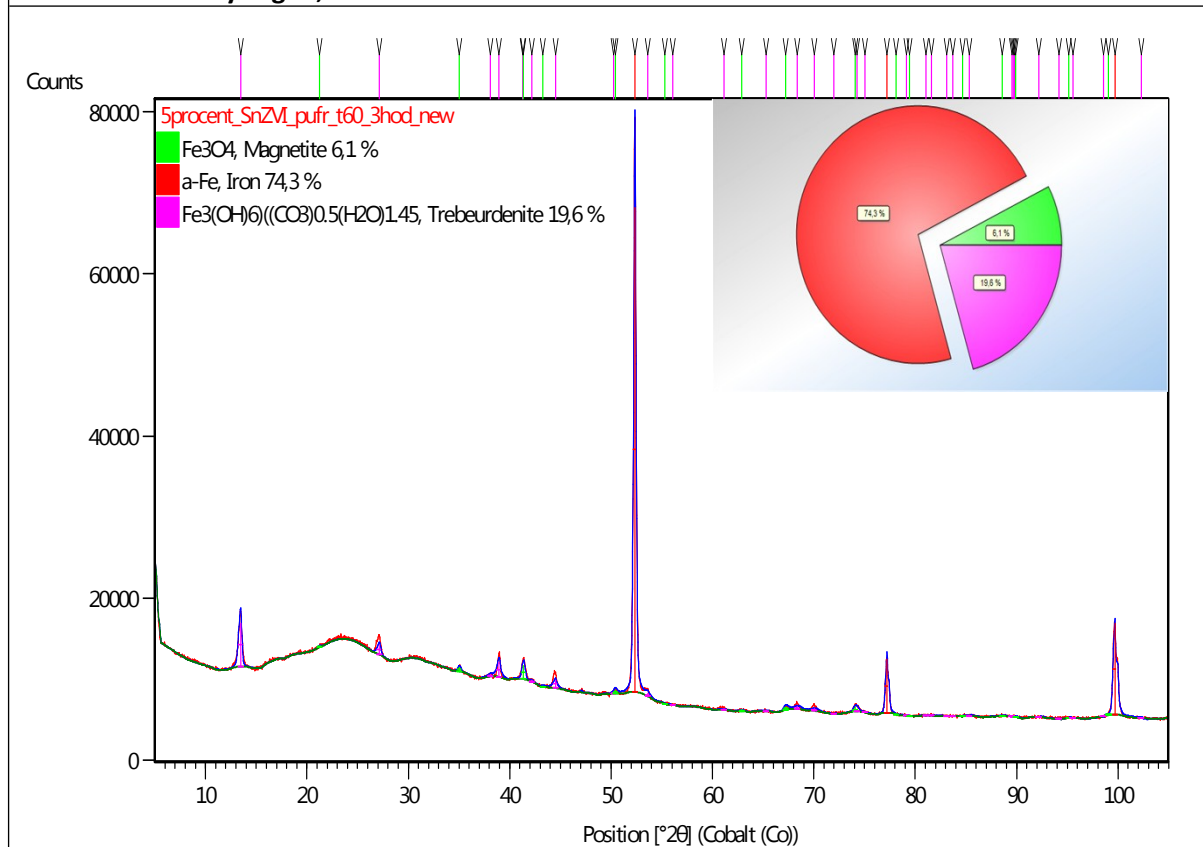
**nZVI: 60 days aged; 24 hours in Soya medium**



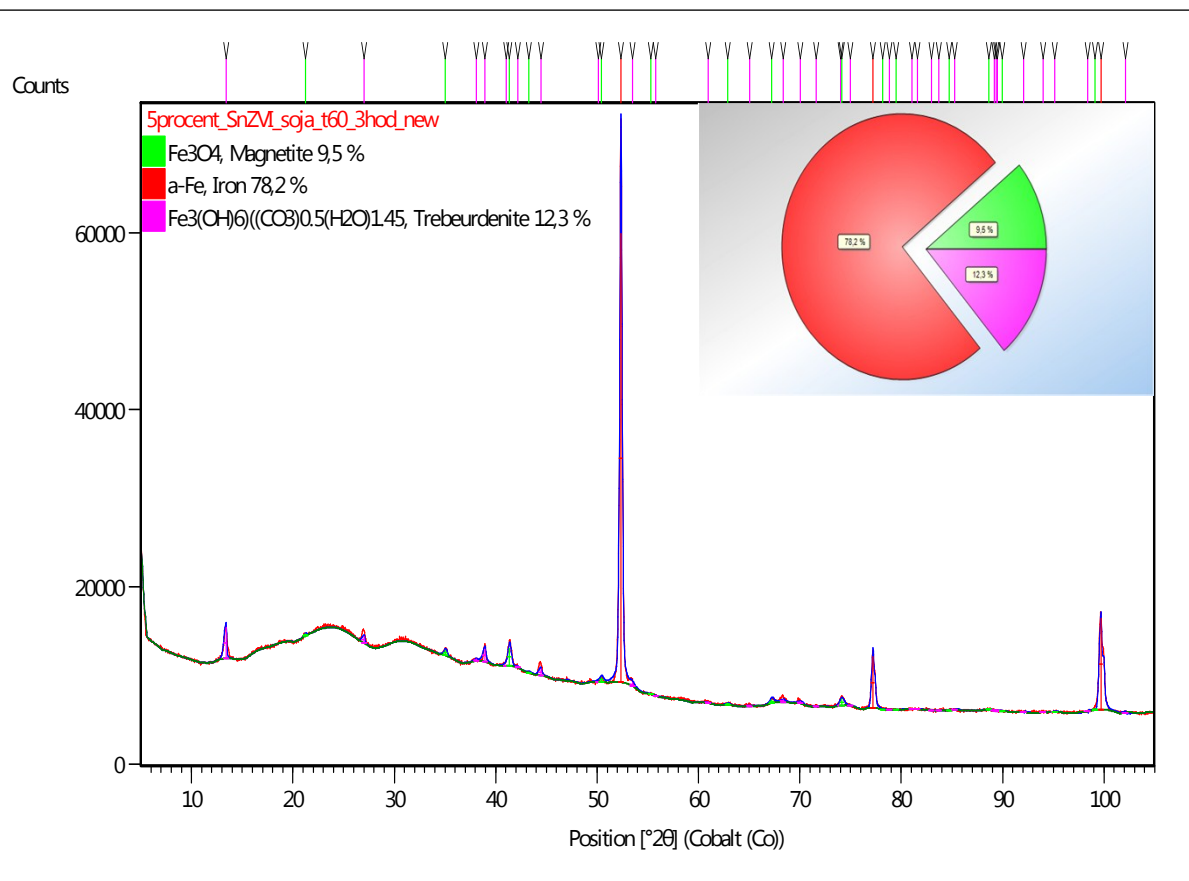
**nZVI: 60 days aged; 48 hours in Sewage sludge**



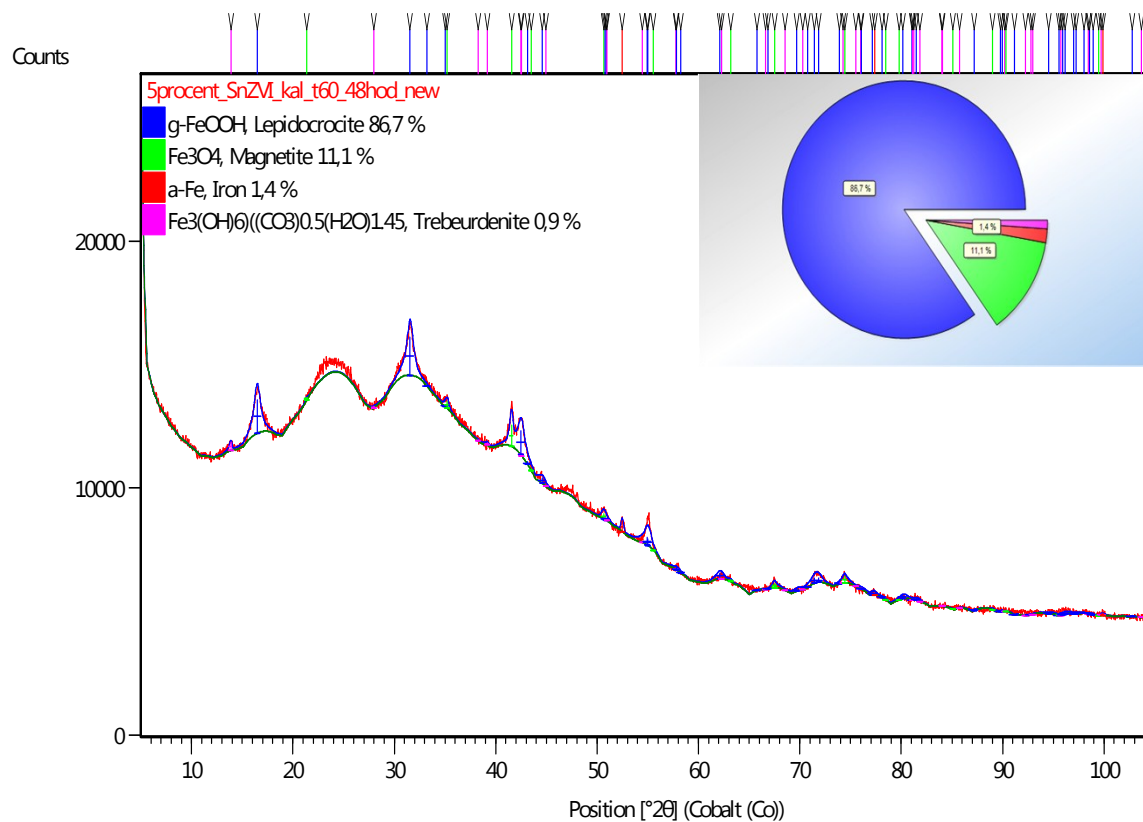
#### 5% S-nZVI: 60 days aged; 3 hours in Carbonate buffer



#### 5% S-nZVI: 60 days aged; 24 hours in Soya medium



#### 5% S-nZVI: 60 days aged; 48 hours in Sewage sludge



**Table S2: Results of spirometry test. Viability of microbial population of activated sludge presented as accumulation of oxygen**

| Time [D] | Accumulation of oxygen [mg/L] |             |          |          |        |
|----------|-------------------------------|-------------|----------|----------|--------|
|          | nZVI                          | 0.25%S-nZVI | 1%S-nZVI | 5%S-nZVI | Medium |
| 0        | 325                           | 100         | 290      | 310      | 300    |
| 7        | 315                           | 290         | 300      | 210      | 280    |
| 14       | 240                           | 260         | 200      | 230      | 290    |
| 30       | 270                           | 260         | 280      | 200      | 275    |
| 60       | 2300                          | 1800        | 2000     | 2200     | 2100   |

**Table S3: Concentration of dissolved iron species after exposition in buffer/medium**

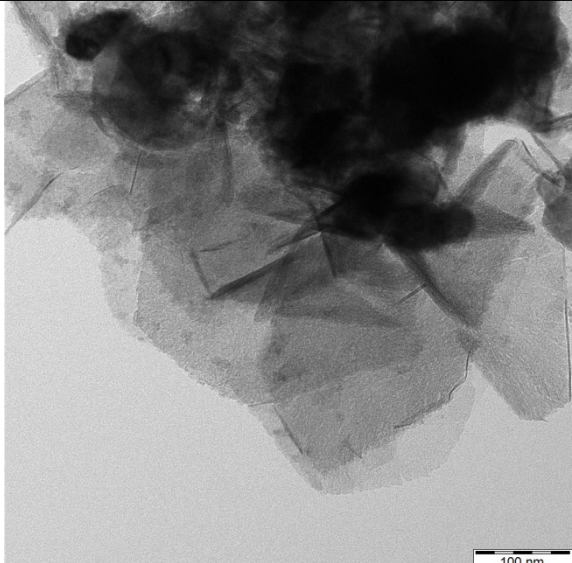
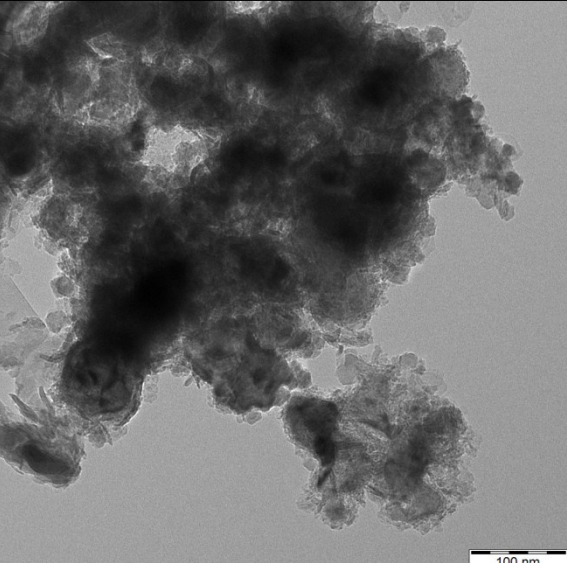
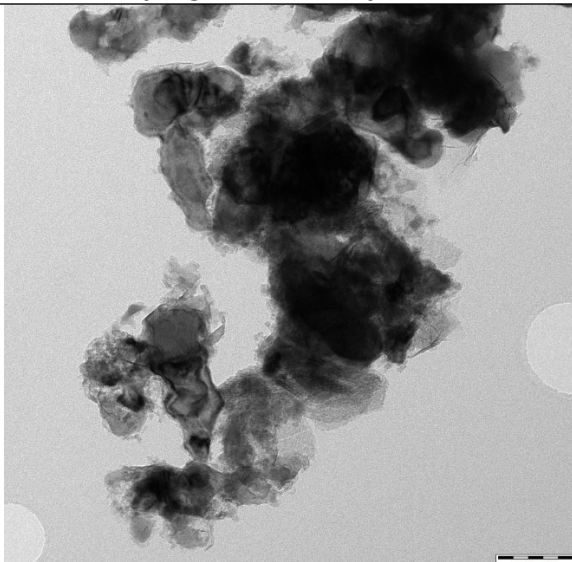
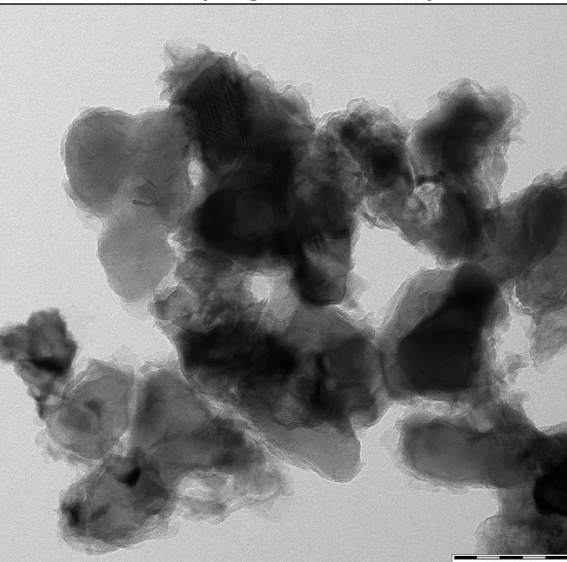
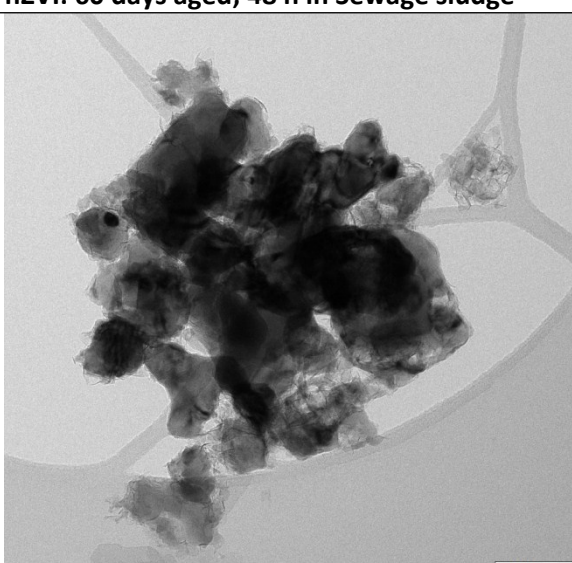
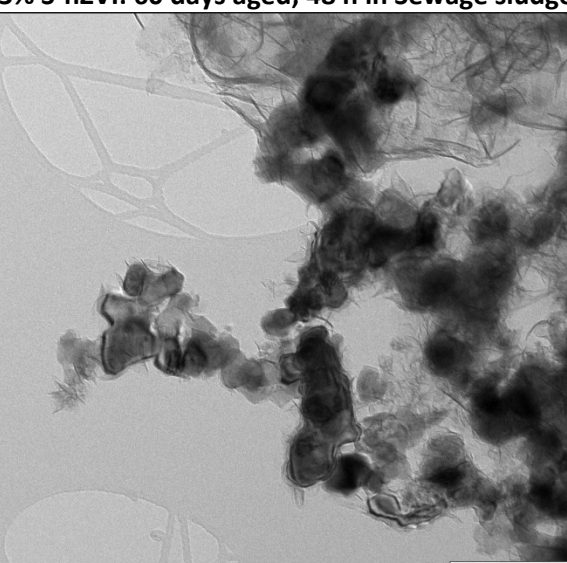
|                                    | Concentration of dissolved iron [mg/l] |        |         |         |
|------------------------------------|----------------------------------------|--------|---------|---------|
|                                    | 0 days                                 | 7 days | 30 days | 60 days |
| <b>Carbonate buffer</b>            |                                        |        |         |         |
| nZVI                               | 0,05                                   | < 0,02 | 3,76    | 2,39    |
| 0,25%_S_nZVI                       | < 0,02                                 | < 0,02 | 2,45    | 3,93    |
| 1%_S_nZVI                          | < 0,02                                 | < 0,02 | 1,09    | 4,61    |
| 5%_S_nZVI                          | < 0,02                                 | < 0,02 | 6,93    | 3,76    |
| <b>Soya broth - aerobic medium</b> |                                        |        |         |         |
| nZVI                               | 0,05                                   | 2,44   | 0,27    | 5,20    |
| 0,25%_S_nZVI                       | 2,95                                   | < 0,02 | 0,18    | 2,95    |
| 1%_S_nZVI                          | 0,77                                   | 0,08   | 4,86    | 3,71    |
| 5%_S_nZVI                          | 0,10                                   | 2,98   | 9,30    | 1,08    |
| <b>Activated Sludge</b>            |                                        |        |         |         |
| nZVI                               | < 0,02                                 | 0,04   | 4,25    | 1,86    |
| 0,25%_S_nZVI                       | < 0,02                                 | < 0,02 | 6,14    | 0,88    |
| 1%_S_nZVI                          | 0,02                                   | < 0,02 | 4,09    | 0,95    |
| 5%_S_nZVI                          | < 0,02                                 | 0,06   | 24,0    | 1,65    |

**Table S4: Concentration of dissolved sulfur species after exposition in buffer/medium**

|                                    | Concentration of dissolved sulfur [mg/l] |         |         |         |
|------------------------------------|------------------------------------------|---------|---------|---------|
|                                    | 0 days                                   | 7 days  | 30 days | 60 days |
| <b>Carbonate buffer</b>            |                                          |         |         |         |
| nZVI                               | ND                                       | < 0,025 | 0,200   | < 0,025 |
| 0,25%_S_nZVI                       | ND                                       | < 0,025 | < 0,025 | < 0,025 |
| 1%_S_nZVI                          | ND                                       | < 0,025 | < 0,025 | < 0,025 |
| 5%_S_nZVI                          | ND                                       | 0,075   | < 0,025 | < 0,025 |
| <b>Soya broth - aerobic medium</b> |                                          |         |         |         |
| nZVI                               | ND                                       | 0,125   | 0,350   | < 0,025 |
| 0,25%_S_nZVI                       | ND                                       | 0,225   | 0,400   | 1,025   |
| 1%_S_nZVI                          | ND                                       | 0,150   | 0,925   | 0,550   |
| 5%_S_nZVI                          | ND                                       | 0,350   | 1,200   | 0,550   |
| <b>Activated Sludge</b>            |                                          |         |         |         |
| nZVI                               | ND                                       | < 0,025 | < 0,025 | < 0,025 |
| 0,25%_S_nZVI                       | ND                                       | 0,050   | < 0,025 | < 0,025 |
| 1%_S_nZVI                          | ND                                       | < 0,025 | < 0,025 | < 0,025 |
| 5%_S_nZVI                          | ND                                       | 0,025   | < 0,025 | < 0,025 |



Table S5: TEM micrographs of nZVI and 5% S-nZVI after exposition in different media

| nZVI: 60 days aged; 3 h in Carbonate buffer                                                                                                                                                                                                                    | 5% S-nZVI: 60 days aged; 3 h in Carbonate buf.                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>TEM micrograph showing nZVI particles in Carbonate buffer. The particles are dark, irregular, and clustered. A scale bar in the bottom right corner indicates 100 nm.</p> |  <p>TEM micrograph showing 5% S-nZVI particles in Carbonate buffer. The particles are dark, irregular, and clustered. A scale bar in the bottom right corner indicates 100 nm.</p> |
| nZVI: 60 days aged; 24 h in Soya medium                                                                                                                                                                                                                        | 5% S-nZVI: 60 days aged; 24 h in Soya medium                                                                                                                                                                                                                         |
|  <p>TEM micrograph showing nZVI particles in Soya medium. The particles are dark, irregular, and clustered. A scale bar in the bottom right corner indicates 100 nm.</p>     |  <p>TEM micrograph showing 5% S-nZVI particles in Soya medium. The particles are dark, irregular, and clustered. A scale bar in the bottom right corner indicates 100 nm.</p>     |
| nZVI: 60 days aged; 48 h in Sewage sludge                                                                                                                                                                                                                      | 5% S-nZVI: 60 days aged; 48 h in Sewage sludge                                                                                                                                                                                                                       |
|  <p>TEM micrograph showing nZVI particles in Sewage sludge. The particles are dark, irregular, and clustered. A scale bar in the bottom right corner indicates 100 nm.</p>  |  <p>TEM micrograph showing 5% S-nZVI particles in Sewage sludge. The particles are dark, irregular, and clustered. A scale bar in the bottom right corner indicates 200 nm.</p>  |

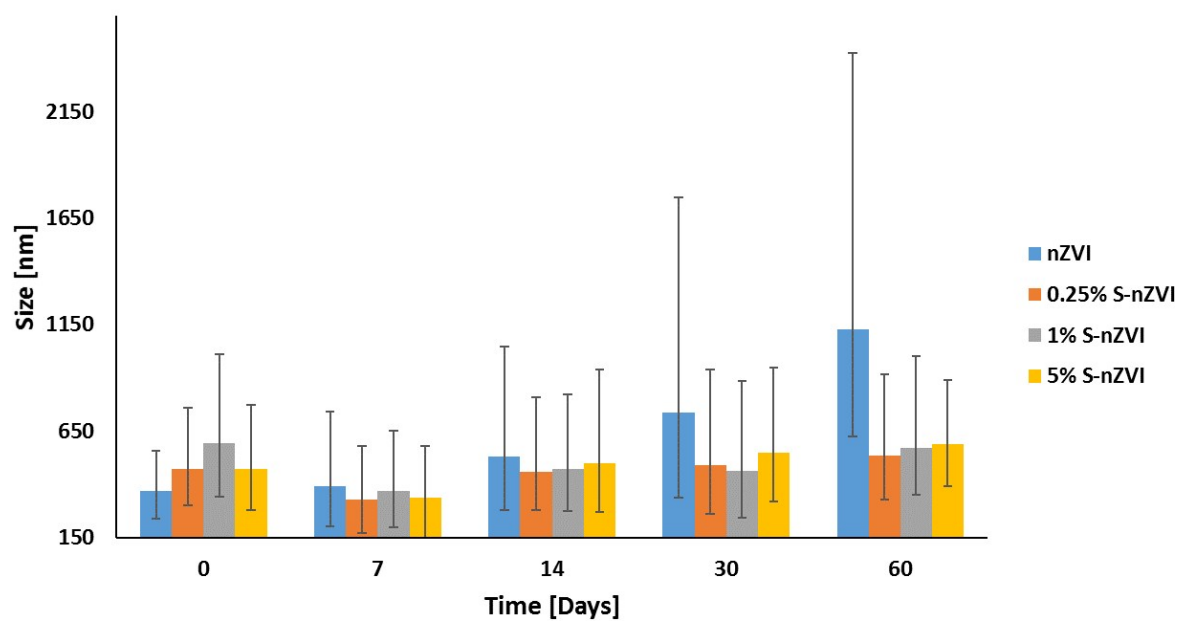
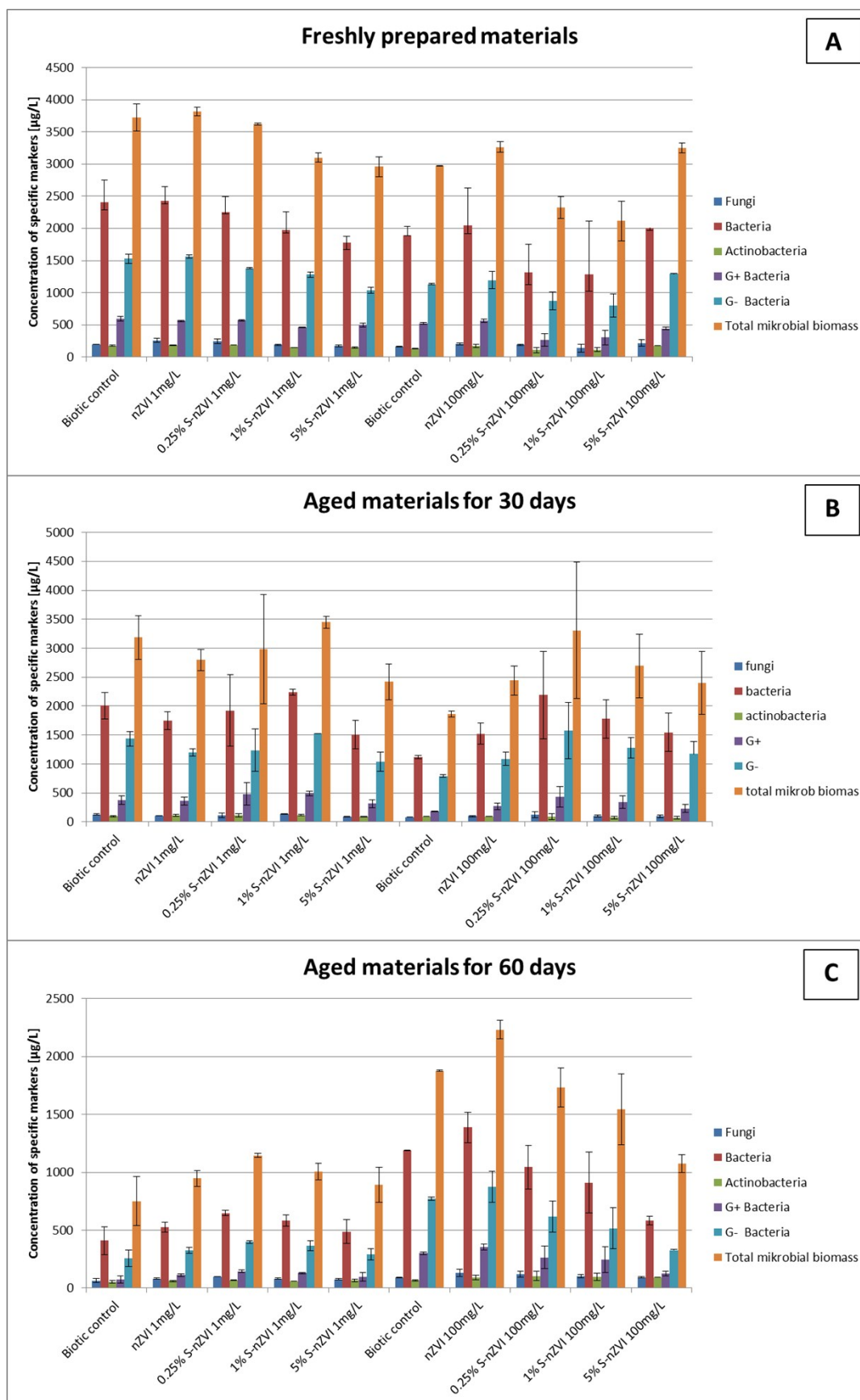


Figure S1: Results of particle size distribution using log-normal distribution analysis. The columns represent the mean and the error bars represent standard deviation



**Figure S2: Results of PLFA analysis from activated sludge after exposition to nZVI and its sulfidated modifications**