Influence of Dispersant and Surfactant on nZVI Characterization by Dynamic Light Scattering

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INTRODUCTION & AIM

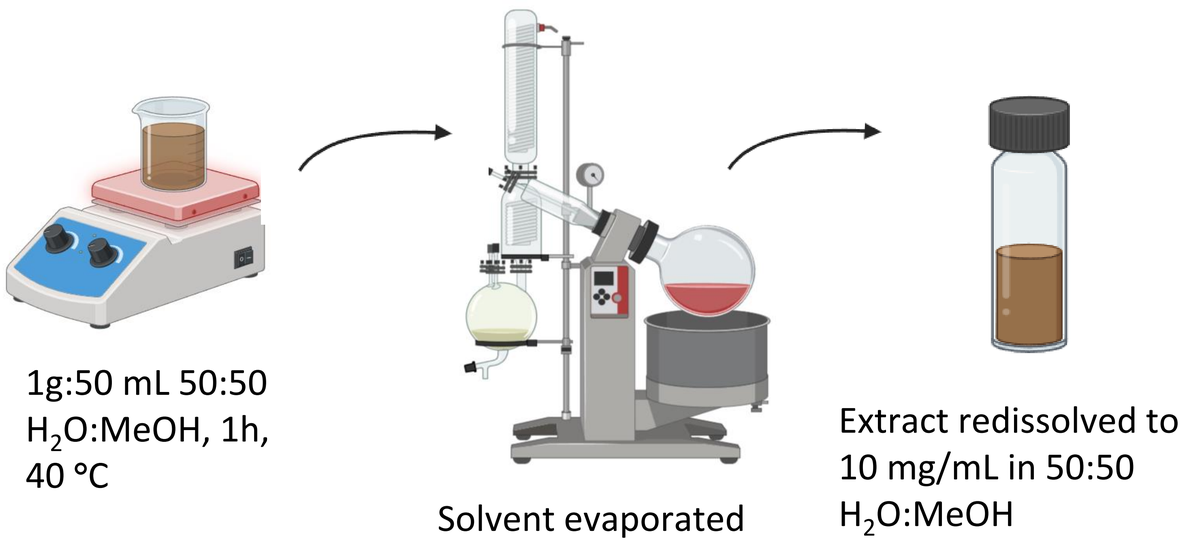
The agrifood industries generate tremendous amounts of waste, which need to be reutilised. Here, spent coffee grounds (SCG) (Figure 1) and *Cistus ladanifer* L. leaves (CLL) (Figure 2) post-distillation residues were used to prepare 50:50 (v/v) hydromethanolic extracts for green zero-valent iron nanoparticles (nZVI) production. After, nZVIs' size, polydispersity index (PDI) and zeta potential (ZP) were determined through dynamic light scattering (DLS).

Figure 1 – Spent coffee grounds (*Coffea arabica* L. and *Coffea robusta* L. blend

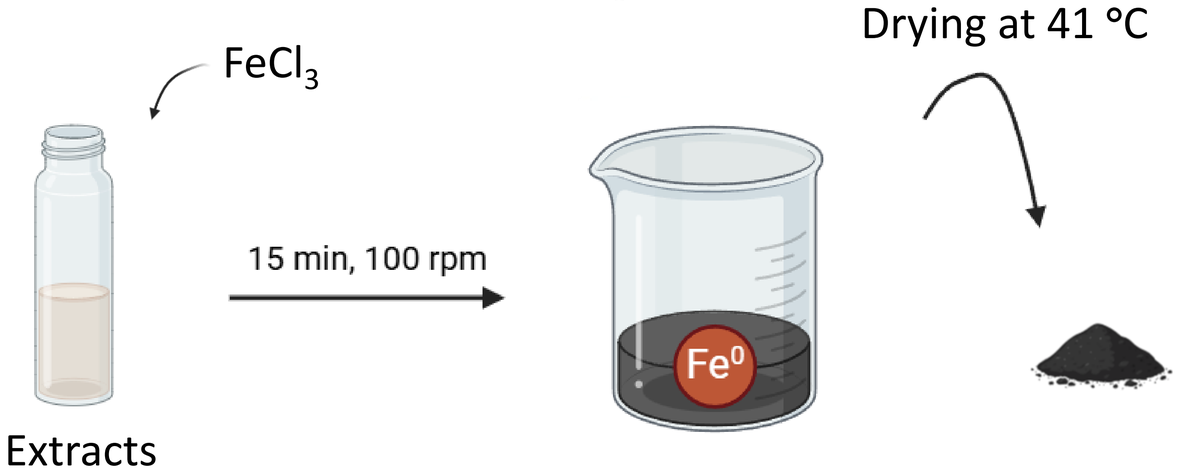
Figure 2 – *Cistus ladanifer* L. leaves

METHODS

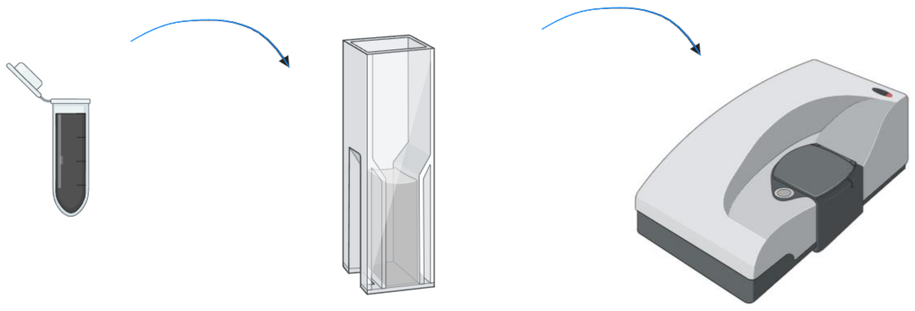
1. Extraction of phenolic compounds



2. nZVI synthesis



3. DLS analysis



nZVI were dispersed in either water or methanol, and Tween®20 was used as a surfactant

RESULTS & DISCUSSION

Table 1– Size, PDI and ZP of the synthesized nZVI

	Size (nm)	PDI	ZP (mV)
SCG met	514.30±135.39	0.43±0.08	-6.72±2.77
SCG w	565.60±80.84	0.56±0.08	-19.57±0.95
SCG met T	2112.33±483.02	0.52±0.14	-4.23±0.19
SCG w T	**14.64±0.76**	**0.24±0.08**	**-5.99±1.71**
CLL met	1552.00±167.78	0.66±0.03	17.48±0.47
CLL w	766.43±129.49	0.68±0.15	-19.13±1.71
CLL met T	1436.00±340.99	0.29±0.08	-0.82±0.12
CLL w T	**13.40±4.26**	**0.31±0.04**	**-5.51±0.86**

Abbreviations: met – methanol; T - Tween®20; w – water

- Water is a better dispersant for DLS analysis when compared to methanol (Table 1).
- Tween®20 can be successfully utilized to reduce nZVI agglomeration, which can be seen in the decrease in mean particle size and PDI (Table 1).
- The addition of Tween®20 influences the ZP of the nZVI (Table 1).

CONCLUSION

nZVI from SCG and CLL were successfully synthesized. Size, PDI and ZP were analysed via DLS. The influence of dispersant was assessed, with water being shown as a better dispersant than methanol. Tween®20 displayed great potential as a surfactant to limit nZVI agglomeration.

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