

Materials Science & Engineering Thesis Defense

Exploring the potential of Electron Paramagnetic Resonance use in healthcare, and assessment of free radicals content in Coffee

School for Engineering of Matter, Transport and Energy

Husain Maki

Advisor: Nathan Newman

Abstract

Electron Paramagnetic Resonance (EPR) has facilitated great scientific advancements in many fields, like material science, engineering, medicine, biology, and health. EPR provided the ability to investigate samples on molecular level to detect harmful substances like free radicals.

This thesis aims to explore current EPR research and investigate the free radical content in paramagnetic materials. After exploring current literature on EPR, an experiment had been conducted to test seven different coffee samples (Turkish coffee, Espresso Coffee, European Coffee, Ground Arabic Coffee, American Coffee, Roasted Arabic Coffee, and Green Arabic Coffee), using Bruker ELEXSYS E580 spectrometer at x-band and under both room temperature (298 K) and low temperature (106 -113 K). The experiment had been conducted under several microwave powers (1, mW, 0.25 mW, 0.16 mW, 0.06 mW, 0.04 mW) and different modulation frequency (10 G, 5G, 3 G). The results revealed average g-value was 2.009, highest linewidth was 16.312. Espresso coffee had the highest concentration of radicals, and green Arabic coffee beans are the lowest. Obtained spectra showed signals of Reactive Oxygen Species (ROS) radicals; believed to be result of natural oxidation process, as well as trace amounts of $CR5^+$ and $Fe3^+$, likely to be naturally found in coffee.



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Zoom Link: <https://asu.zoom.us/j/3865432731>