

## Influence of Magnetic Field on the Antibacterial Properties of Pine Oil

**Authors :** Dawid Sołoducha, Tomasz Borowski, Agata Markowska-Szczupak, Aneta Wesołowska, Marian Kordas, Rafał Rakoczy

**Abstract :** Many studies report varied effects of the magnetic field in medicine, but applications are still missing. Also, essential oils (EOs) were historically used in healing therapies, food preservation and the cosmetic industry due to their wound healing and antioxidant properties and antimicrobial activity. Unfortunately, the chemical characterization of EOs activates its antibacterial action only at a fairly high concentration. They can cause skin reactions, e.g., irritation (irritant contact dermatitis) or allergic contact dermatitis; therefore, they should always be used with caution. However, the administration of EOs to achieve the desired antimicrobial activity and stability with long-term medical usage in low concentration is challenging. The aim of this work was to investigate the antimicrobial activity of commercial *Pinus sylvestris* L. essential oil from Polish company Avicenna-Oil® under Rotating Magnetic Field (RMF) at  $f = 1 - 50$  Hz. The novel construction of the magnetically assisted self-constructed reactor (MAP) was applied for this study. The chemical composition of essential pine oil was determined by gas chromatography coupled with mass spectrometry (GC-MS). Model bacteria *Escherichia coli* K12 (ATCC 25922) was used. Different concentrations of pine oil was prepared: 100%, 50%, 25%, 12.5% and 6.25%. The disc diffusion and MIC test were done. To examine the effect of essential pine oil and rotating magnetic field RMF on antibacterial performance agar plate method was used. Pine oil consist of  $\alpha$ -pinene (28.58%),  $\beta$ -pinene (17.79%),  $\delta$ -3-carene (14.17%) and limonene (11.58%). The present study indicates the exposition to the RMF, as compared to the unexposed controls causing an increase in the efficacy of antibacterial properties of pine oil. We have shown that the rotating magnetic fields (RMF) at a frequency,  $f$ , between 25 Hz to 50 Hz, increase the antimicrobial efficiency of oil at lower than 50% concentration. The new method can be applied in many fields e.g. aromatherapy, medicine as a component of dressing, or as food preservatives.

**Keywords :** rotating magnetic field, pine oil, antimicrobial activity, *Escherichia coli*

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