

Temperature dependence of surface tension in three essential oils with application as adjuvants in agriculture

Zdravko Gandov, Sabahtin Karaibryam, Vanya Gandova, Ivalina Petrova

Technical University Sofia, branch Plovdiv, 4002 Plovdiv, Bulgaria
ivalinapetrova.com@abv.bg

ABSTRACT

The surface properties of three types essential oils (*Pinus sylvestris*, *Juniperus communis* and *Oreganum herachoticum*) were investigated as application of adjuvants. The surface tension was measured in both pure oils and solutions with concentrations: 0.001, 0.01 and 0.1 % v/v at different temperatures: 10, 25, 30, 35 and 40°C. After comparison of surface tension between three oil some low values exhibit *Pinus sylvestris* (33.61±0.21 to 16.13±0.11 mN.m⁻¹) following of *Juniperus communis* (38.25±0.17 to 20.91±0.07 mN.m⁻¹) and *Oreganum herachoticum* (41.93±0.15 to 25.75±0.12 mN.m⁻¹). This results confirm that these essential oils can be used as adjuvants in agriculture.

RESULTS AND DISCUSSION

The surface tension of three essential oils (*Pinus sylvestris*, *Juniperus communis* and *Oreganum herachoticum*) and their aqueous solutions was measured. The measurements were provided in temperatures: 10, 25, 30, 35 and 40°C and concentrations: 0.001, 0.01 and 0.1 % v/v. The obtained results for pure oils were presented in Table 1. For pure water standard value of surface tension γ is equal to 72.75 mN.m⁻¹. The essential oils had tension less from the water and this defines them as surfactants. These properties determine the essential oils, such as adjuvants. According Table 1 the *Pinis sylvestris* exhibit a less surface tension compared with two others essential oils. Classical temperature dependence in three essential oils was observed too that with increase of temperature the surface tension decrease. In this case the warmer weather favors adjuvants in various sprays on plants. The dependence between surface tension and temperature is presented on Fig. 2. On the figure seen classical temperature dependence. With increased of temperature surface tension decrease.

The density of pure essential oils was determined and different temperatures again. A directly proportional relationship was observed between surface tension and density. When the surface tension increases, the density also increases. For *Pinus sylvestris* values of density are 0.887 to 0.907 kg.m⁻³. For *Juniperus communis* and *Oreganum herachoticum* values are 0.889 to 0.945 and 0.918 to 0.936 kg.m⁻³, respectively.

Table 1. Surface tension in three essential oils

t °C	<i>Pinus sylvestris</i>	<i>Juniperus communis</i>	<i>Oreganum herachoticum</i>
10	33.61 ± 0.21	38.25 ± 0.17	41.93 ± 0.15
25	27.75 ± 0.33	28.08 ± 0.14	34.62 ± 0.09
30	24.86 ± 0.15	25.21 ± 0.08	32.36 ± 0.16
35	20.51 ± 0.11	23.83 ± 0.26	29.57 ± 0.11
40	16.13 ± 0.11	20.91 ± 0.07	25.75 ± 0.12

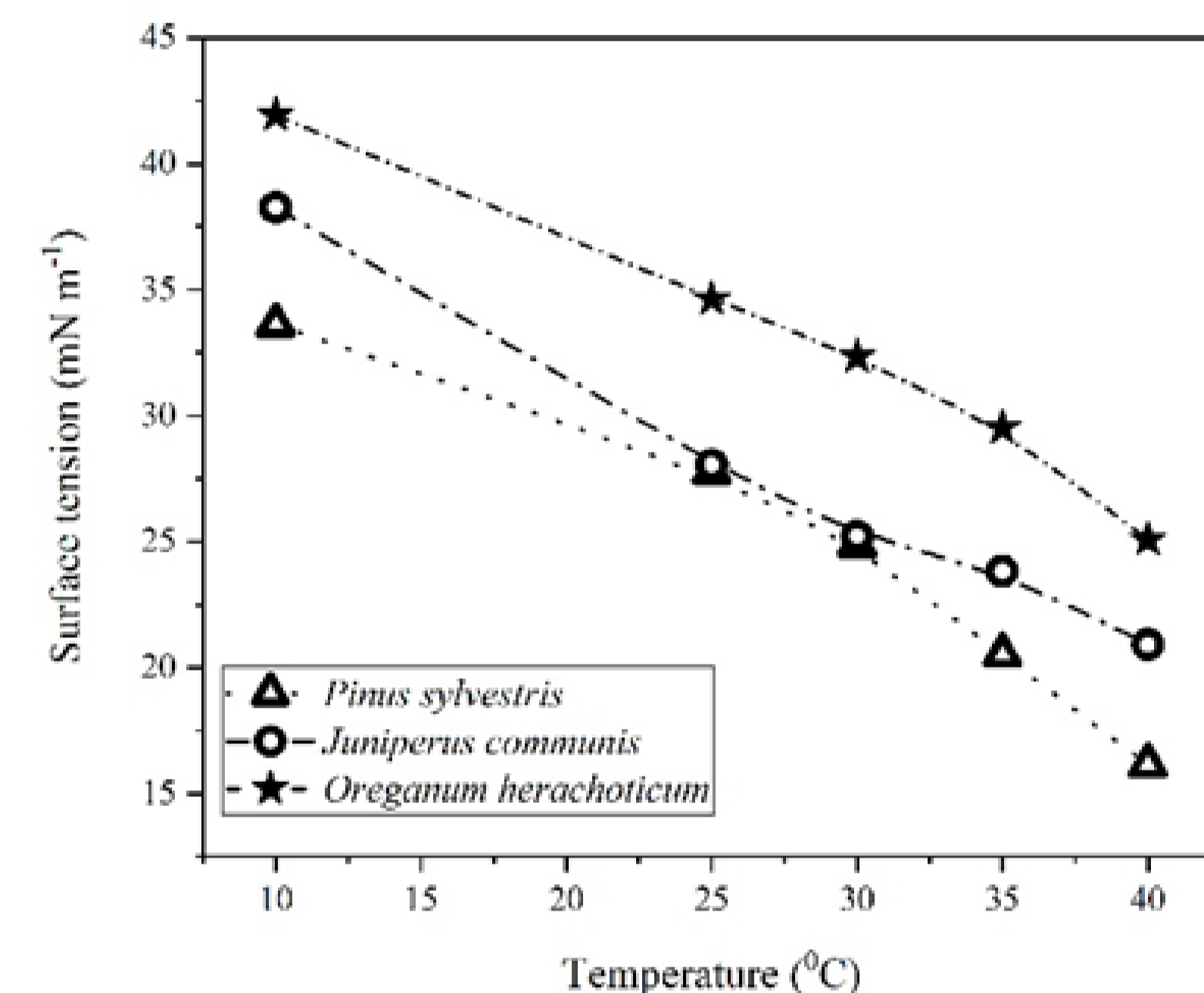


Fig. 1. Dependence between temperature and surface tension in three essential oils.

CONCLUSIONS

Three types essential oils *Pinus sylvestris*, *Juniperus communis* and *Oreganum herachoticum*, were investigated and found that added in solutions decreased surface tension. In this case they can used as adjuvants in various sprays on plants. The solution with different concentrations of each oil were investigated by surface tension measurements. The surface tension was measured in pure oils and in solutions at different temperatures: 10, 25, 30, 35 and 40°C. The best qualities as adjuvant exhibit *Pinus sylvestris* (33.61 ± 0.21 to 16.13 ± 0.11 mN.m⁻¹) following of *Juniperus communis* (38.25 ± 0.17 to 20.91 ± 0.07 mN.m⁻¹) and *Oreganum herachoticum* (41.93 ± 0.15 to 25.75 ± 0.12 mN.m⁻¹). After obtained results these essential oils can be used as adjuvants with application in agriculture.