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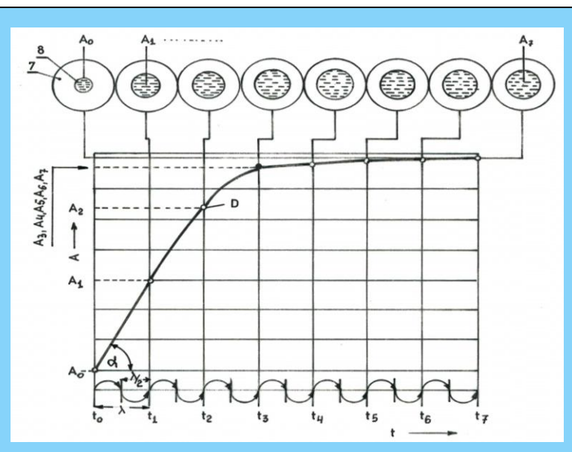
METHOD AND SENSORY SYSTEM FOR DETERMINATION OF THE LIQUIDS SURFACE TENSION

AUTORS

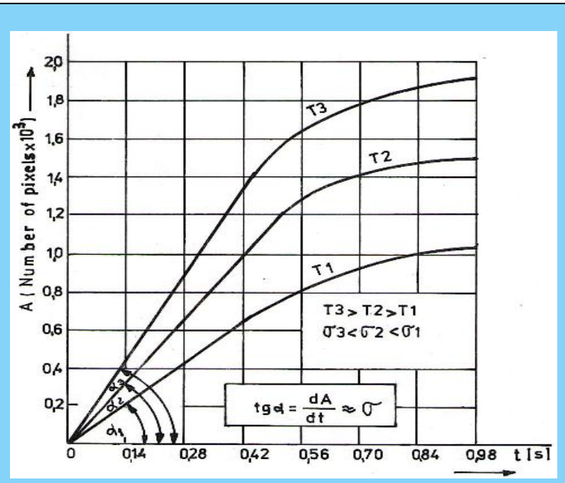
Sonia Amariei*, Gutt Gheorghe*, Norocel Liliana*
E-mail: sonia@usm.ro
* Universitatea Stefan cel Mare din Suceava – Romania

ABSTRACT

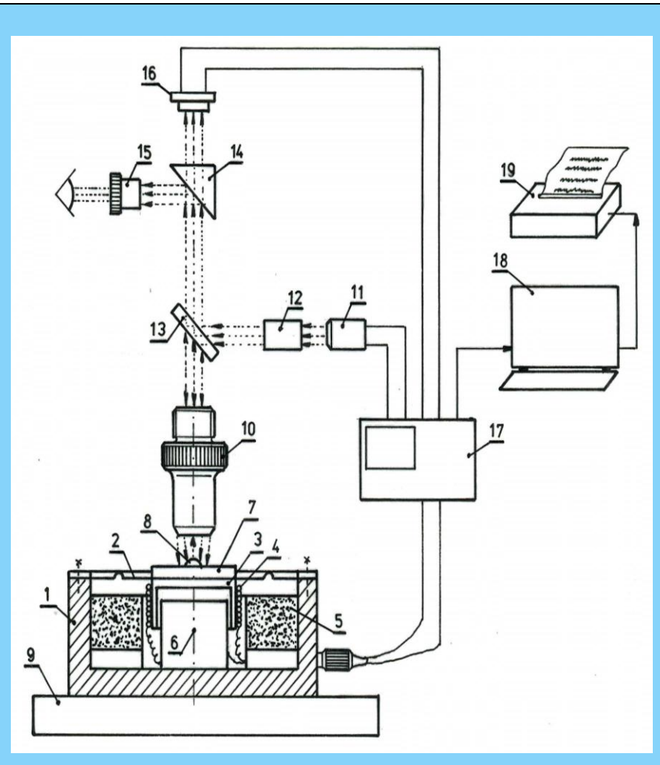
A new method and related sensory system used to determine the surface tension (γ) of a liquid investigated based on the increase of the area (A) of a drop vibrated sinusoidally is presented. The materialization of the method consists in specific device placed on the table of a microscope or a stereomicroscope, both based on the principle of light reflection. A drop of the analyzed liquid deposited with a dispenser on a metal plate, vibrated electrodynamically under the action of a sinusoidal oscillation, of constant frequency and amplitude, increases its surface wetted on the metal plate with each applied sinusoidal oscillation. At each magnification of the drop surface area, an image acquisition takes place through the optoelectronic system of the microscope or stereomicroscope, the frequency of the oscillations being strictly correlated with the acquisition frequency of the images. At a predetermined number of images / oscillations through a specific software, both the images of the droplets and the graph containing the number of pixels inside the outline of each image and the current number of vibration corresponding to that image are displayed. The surface tension is automatically expressed by the growth speed of the drops surface, speed given by the curve slope of the pixels number of the drops according to the current number of the oscillation. A collateral application, is the possibility of using the sensory system and specialized software for the rapid determination of the concentration of solutions, while measuring the surface tension using the Szyszkowski relation [4].



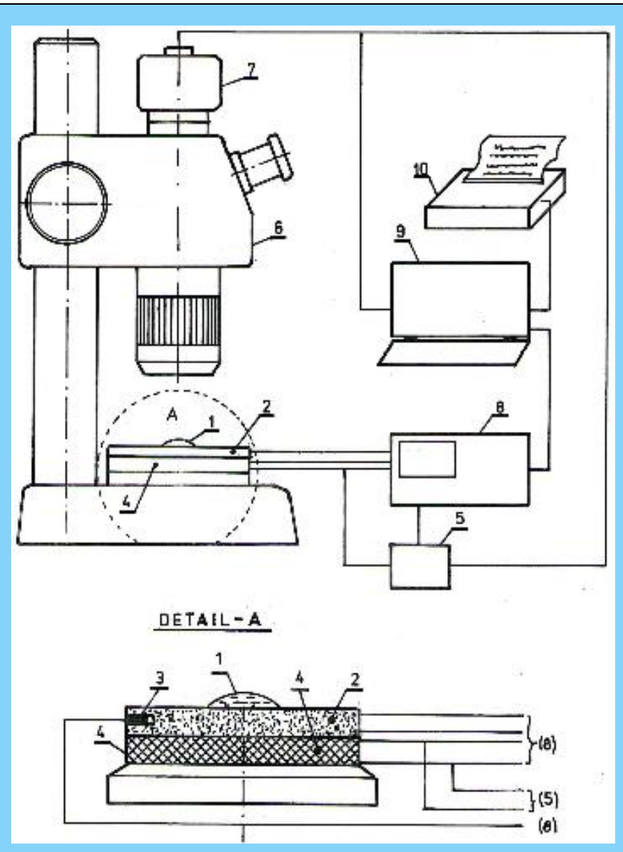
Evolution of the area (A) of the surface of a drop of liquid, sinusoidally vibrated for a certain time (t)



The family of curves expressing the speed of increase in the area (A) of the surface of a liquid droplet analyzed according to the time (t) at three different temperatures (T1), (T2), T3) of working.



Schematic diagram used for measuring surface tension by vibration by optoelectronic tracking over time of the evolution of the surface of a drop of liquid analyzed. 1-cylindrical metal body, 2-hardened steel elastic membrane, 3-non-metallic tube, 4-electric coil, 5-permanent magnet, 6-magnetic core, 7-stainless steel disc, 8-drop of the analyzed liquid, 9- stereomicroscope table, 10-optical lens, 11-polychromatic radiation source, 12-optical collimator, 13-semitransparent mirror, 14-optical prism, 15-two ocular lens,, 16-CCD image detector, 17-electronic unit, 18-electronic computer, 19-electronic printer



Schematic diagram of the mobile equipment for determining the surface tension of liquids at various temperatures using a piezoelectric actuator for vibration.1-drop of liquid analyzed, 2-Peltier thermoelectric element, 3-temperature sensor, 4-actuator, piezoelectric with controlled frequency, 5-phase and frequency electronic comparator, 6-optical stereomicroscope, 7-video camera, 8-electronic unit, 9-electronic computer, 10-electronic printer

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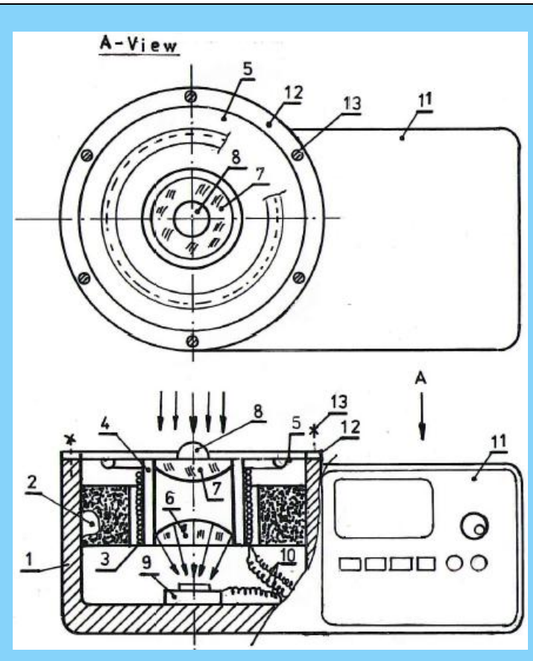
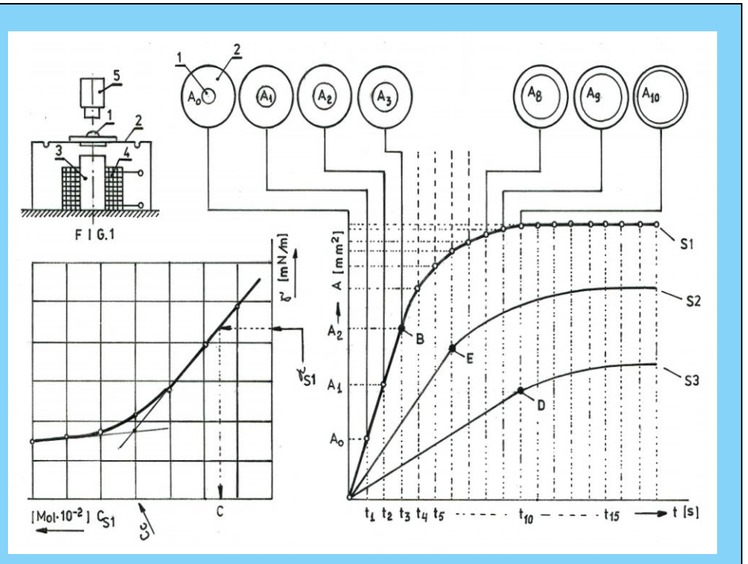


Section front view and top view of a portable apparatus for determining surface tension in liquids. 1-cylindrical compartment, 2-permanent magnet, 3-electric coil, 4-non-metallic cylindrical support, 5-elastic disc membrane, stainless steel, 6,7-convex plane optical lenses, 8-drop of the analyzed liquid, 9-sensor CCD video, 10-electrical conductors, 11-electronic unit, 12-disk membrane clamping ring, 13-tightening screws.



a) Determination of concentration (c) as a surface tension (γ) according to Szyszkowski's relation for chemical species (S1).b) Evolution of the surface areas of three liquid droplets from three solutions (S1), (S2), (S3), containing each chemical species depending on the time(t). 1 drop of liquid whose surface tension is determined, 2-elastic membrane made of stainless steel, steel core with low percentage of carbon, 4- electric coil, A1 - A10 the areas of the surfaces of the drops of liquid following 10 electrodynamic vibrations.

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