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Design and construction of a low-cost AC conductivity meter to test solutions

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Conductivity measurements in freshwater samples are crucial as drinking high conductive water could lead to health issues. A low-cost conductivity meter was constructed to measure low conductivities in the range that freshwater samples carry.

The device is constructed with two-pole cell made up of cylindrical Graphite electrodes. Alternating Current I, at optimal frequency 500 Hz was applied to the electrodes immersed in the solution and the voltage difference between the electrodes (V) was measured. The optimal frequency of the cell was determined by considering 50 - 2000 Hz frequency range of the supply voltage. Conductivity of the solution is directly proportional to the conductance, I/V. The cell constant (K_{cell}), which is the ratio of the conductivity to the conductance of the solution, depends only on the cell geometry. The cell was designed so that K_{cell} = 0.247 cm^{-1}. Standard KCl solutions in the range 5 - 2765 µS/cm at 25 ºC were used to calibrate the device. Some standard NaCl solutions of 21, 64, 210, 617 and 1990 µS/cm were analyzed and found that those conductivities were in good agreement with their standard values up to 50 µS/cm. Conductivities of all solutions measured using a conductivity meter available in the market showed close agreement with standard values for low conductivity solutions, but showed a much higher difference of 320 µS/cm for the solution with conductivity 1990 µS/cm. 99.6 % accuracy with $\pm 10^{-3}$ µS/cm tolerance can be expected from the constructed device for the range of conductivities, 5 - 2765 µS/cm.

Keywords: conductivity meter, construction, AC and freshwater

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