Smartphone-Based Spectrometer for Oil Sample Analysis

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Spectrometers are highly valuable tools capable of measuring the wavelengths emitted or absorbed by various objects and materials. However, scientific-grade spectrometers are often costly, typically ranging from several hundred to several thousand dollars. By leveraging computer-aided design (CAD), diffraction gratings, 3D printing, and smartphones, it is possible to construct a low-cost, makeshift spectrometer. The core component of the spectrometer is a transmission diffraction grating, which disperses incoming light into its constituent spectrum. By allowing a controlled amount of light to pass through a small aperture and positioning a smartphone camera at the opening, the dispersed light can be captured for analysis. For calibration, violet, green, and red laser pointers were used. Captured images were analyzed using ImageJ software to generate intensity profiles. To validate the system, five oil samples—olive oil, avocado oil, sesame oil as well as their mixture, were tested. Each sample produced distinct spectral absorption characteristics, particularly in the location of their peak values.

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