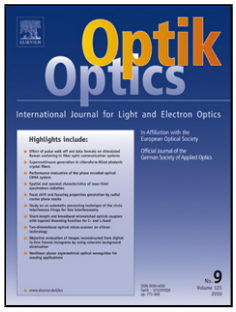

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Optical effects of thermocavitation in natural plant extracts

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Abstract

An extra-cavity pulse generation by thermocavitation in a Hibiscus sabdariffa extract (a natural anthocyanin) is presented. This is, to the best of our knowledge, the first experimental demonstration of thermocavitation in a natural extract. It is also demonstrated that the solution of anthocyanins is acting as an optical shutter triggered by thermocavitation.

Cavitation is the formation of cavities in liquids. It is created, for example, wherever liquid is agitated violently, like in boat propellers and hydraulic machinery [1-3]. Cavitation may be a useful tool in fields such as medicine, where it can be used for lithotripsy and drug delivery [4] or as an activation system for contrast agent for blood clot disruption [5]. Laser induced cavitation is generally produced by short laser pulses focused on liquids [6–10]. The light intensity at the focus is so high that nonlinear absorption and/or avalanche ionization leads to plasma formation. Due to the high absorption coefficient of plasma in the visible spectrum, it can be rapidly heated by the laser beam to temperatures on the order of 7000-10000°K [11,12] and pressures as high as MPa or even GPa [13,14] leading to rapid vaporization of water producing audible acoustic shock waves. When a focused CW laser beam heats a small part of volume of liquid, an overheated region is created at the focal point, leading the formation of a bubble as a result of an explosion by evaporation of the liquid. Once the bubble reaches a cooler area of liquid, it collapses very rapidly