

MANAGEMENT • INVESTMENT • ECONOMICS • ENTREPRENEURSHIP • TECHNOLOGY

FIVE IMPORTANT TIPS TO HELP NOVICE
ATHLETES IN SPORTS CONFIDENCE

Turmeric & Coffee

The Suprising Ingredient Generating Short-Pulsed Laser

EMAIL CARBON FOOTPRINT

A SOURCE FOR GREENHOUSE GASES EMISSIONS

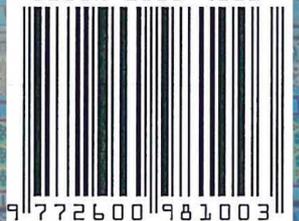
Creating Happiness

IN WORK AND LIFE IN SOCIETY: A RELIGIOS PERSPECTIVE

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These developments have played a significant role in advancing next-generation photonics and optoelectronic technologies. Surprisingly, recent research has shown that environmentally friendly resources, such as coffee and turmeric, can also be used to generate laser light. For instance, Rusdi et al. (2020) have successfully demonstrated passively Q-switched pulse fiber lasers using a saturable absorber made from spent coffee grounds (SCG). The SCG powder has been purified and embedded with polyvinyl alcohol (PVA) to form a thin film, which has then been integrated into three different fiber-laser cavities, including ytterbium-doped (YDFL), erbium-doped (EDFL), and thulium-doped fiber lasers (TDFL), to realise a Q-switching operation. Al-Hiti et al. (2021) have reported a passively Q-switched EDFL at 1566.96 nm by applying an organic material based on turmeric as the SA. The material has also been prepared by embedding turmeric powder into a PVA film.

In summary, the use of natural materials, such as coffee and turmeric as the SA devices in fiber-laser systems, offers several advantages, including eco-friendliness, low cost, and ease of fabrication. These materials have shown an excellent performance in generating pulsed lasers at various wavelengths, making them suitable for various photonic applications. Future research in this area could explore other environmentally friendly materials that can be used as the SA, potentially leading to even more sustainable and cost-effective fiber-laser systems.

References:

- M. F. M. Rusdi et al., "Generation of Q-switched fiber laser at 1.0-, 1.55- and 2.0- μm employing a spent coffee ground based saturable absorber," *Opt. Fiber Technol.*, vol. 61, no. November 2020, p. 102434, 2021.
- A. S. Al-Hiti, A. H. H. Al-Masoodi, W. R. Wong, M. Yasin, A. H. H. Al-Masoodi, and S. W. Harun, "Nanosecond passively Q-switched fiber laser in the 1.5 μm region using turmeric saturable absorber," *Opt. Laser Technol.*, vol. 139, p. 106971, Jul. 2021.

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Enhancing Food Safety with SPR Biosensors

Food safety refers to measures and practices taken to ensure that food is free from harmful contaminants and pathogens, making it safe for human consumption. This includes everything from food production, processing, packaging, and storage to the handling and preparation of food by consumers. The goal of food safety is to identify and control potential hazards such as bacteria, viruses, chemicals, and physical hazards at every stage of the food supply chain to minimize the risk of foodborne illness and protect public health.

The utilization of SPR biosensors in food analysis has significant potential for enhancing food safety. These sensors have the capability to detect a broad spectrum of analytes, such as proteins, peptides, antibodies, toxins, and bacteria, with high accuracy and sensitivity. This real-time identification of potential contaminants and pathogens in food samples allows for prompt and appropriate measures to prevent outbreaks of foodborne diseases. For example, SPR biosensors can detect the presence of food allergens such as gluten or peanuts in food products, helping prevent allergic reactions in susceptible individuals. SPR biosensors can also monitor food quality and safety throughout the entire food supply chain, from farm to table. For instance, they can detect pesticide residues in crops, monitor the freshness of seafood, and detect bacterial contamination in meat and dairy products.

An SPR biosensor typically comprises two main components: an optical system that excites and interrogates surface plasmons and a biomolecular recognition element that is immobilized on a metal layer and used to capture and identify target analytes in a sample, as shown in Figure 1. When a food sample is introduced to the biosensor, any analytes present in the sample that bind to the recognition element cause a change in the refractive index of the metal layer, which is detected through the shift in the SPR signal. This shift is proportional to the amount of bound analyte, allowing for the precise quantification of contaminants or pathogens and the determination of binding kinetics, specificity, affinity, and concentration of biomolecules in the food sample. The change in refractive index is caused by variations in mass and chemical reactions occurring on the sensor surface during the binding event. The binding rate gradually decreases until the association and dissociation processes reach equilibrium. Additionally, the surface temperature can affect the refractive index.

In summary, SPR is a powerful label-free, highly sensitive, and real-time technique for studying the interaction between biological molecules on the surface of a sensor. It has various applications, including the detection of adulteration, biomolecules such as proteins, carbohydrates, vitamins, antioxidants, and nucleic acids, as well as in the detection of genetically modified foods, microorganisms, and more (Ravindran et al., 2023). The continued development of SPR biosensors with improved sensitivity and selectivity will likely expand their application in the future.

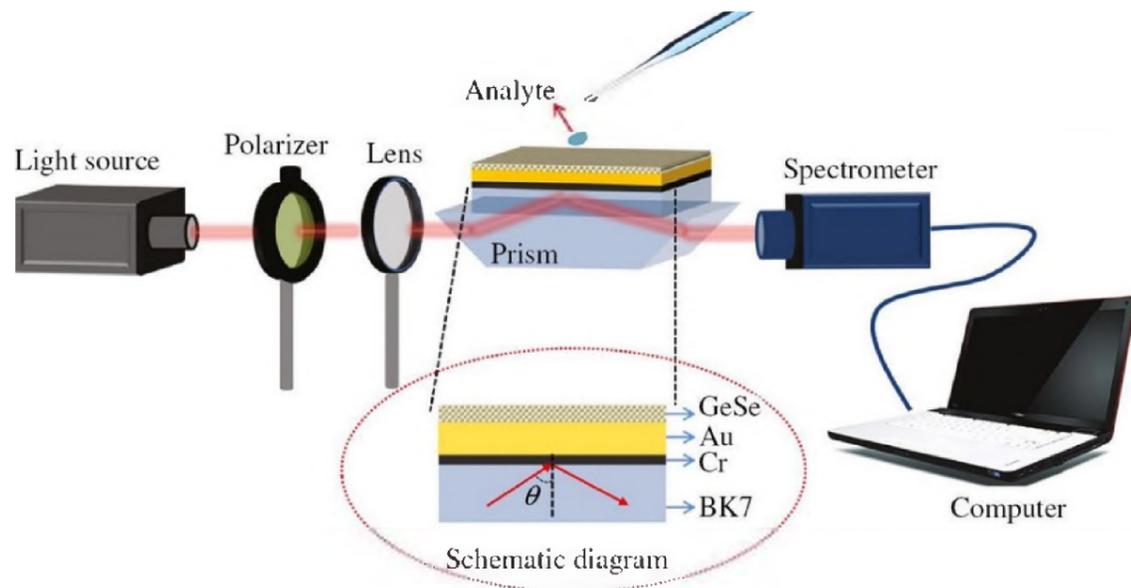


Figure 1. The basic experimental setup of an SPR biosensor (Zhao et al., 2020)

References:

- Ravindran, N., Kumar, S., M, Y., S, R., C A, M., Thirunavookarasu S. N., & C K, S. (2023). Recent advances in Surface Plasmon Resonance (SPR) biosensors for food analysis: a review. *Critical Reviews in Food Science and Nutrition*, 63(8), 1055-1077. <https://doi.org/10.1080/10408398.2021.1958745>
- Zhao, Y., Gan, S., Wu, L., Zhu, J., Xiang, Y., & Dai, X. (2020). GeSe nanosheets modified surface plasmon resonance sensors for enhancing sensitivity. *Nanophotonics*, 9(2), 327-336. <https://doi.org/10.1515/nanoph-2019-0170>

RARE EARTH ELEMENTS (REES) 101 :



WHAT SHOULD WE KNOW?

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WHAT IS REE ?

➤➤➤ RARE EARTH ELEMENTS (REE)

Rare Earth Elements (REEs), a set of seventeen chemically similar but unique elements, have emerged as critical components in modern technology, industry, and scientific advancement. These elements, which are found in the bottom two rows of the periodic table, possess unique electronic, magnetic and optical properties that make them important in a variety of applications.

RARE EARTHS ARE CATEGORISED INTO LIGHT ELEMENTS (LANTHANUM TO SAMARIUM) AND HEAVY ELEMENTS (EUROPIUM TO LUTETIUM). THE LATTER ARE LESS COMMON AND CONSEQUENTLY MORE EXPENSIVE.



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