PRINCIPLES OF PET IMAGING TOOLS AND PET PROTOCOLS USING COMSOL SIMULATION

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The integration of positron emission tomography and computed tomography (PET/CT) has evolved. Important imaging technology, especially in oncology, introduced to the commercial market in 2001 imaging. In routine clinical practice, PET/CT has had a major impact on diagnosis [1].

Cancer patients by planning and monitoring treatment response, unique properties that combine the high sensitivity of PET components with the specificity of CT, the components make PET/CT still one of the fastest growing imaging modalities, 14 years after its clinical Start point [2].

There are four materials with Magnetic Nature and Bio-Physical Nature had been used during the simulation with their physical and chemical characteristics as inputs (Cooper, Skin, Skull, and Brain).

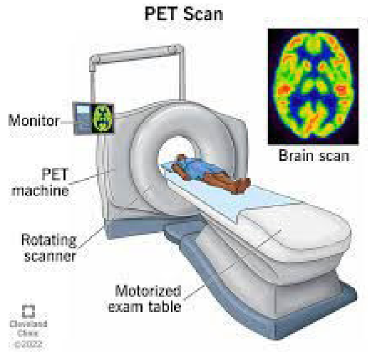

Fig. 1. *PET Scan Device, based on Brain Diagnosis for treatment of tumour [2]*

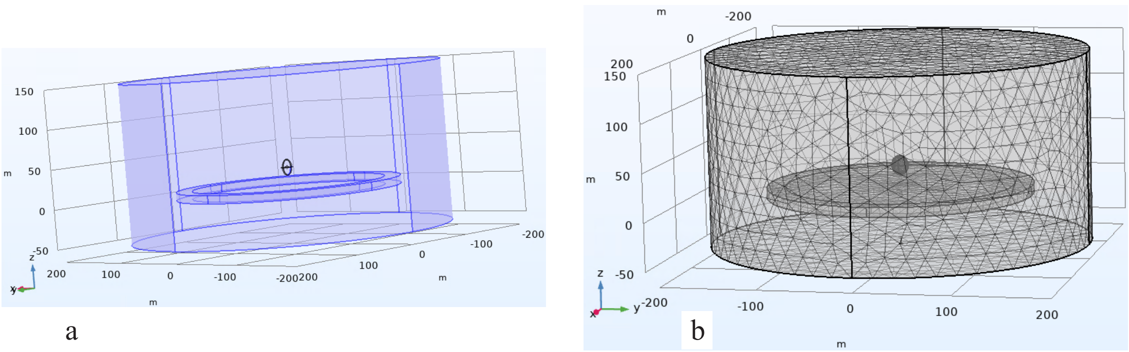

Fig. 2. *PET Scan Analysis Using COMSOL Simulation for Brain Tumour Treatment (a) Grid 3 D for PET device (b) Mesh Analysis for PET Device*

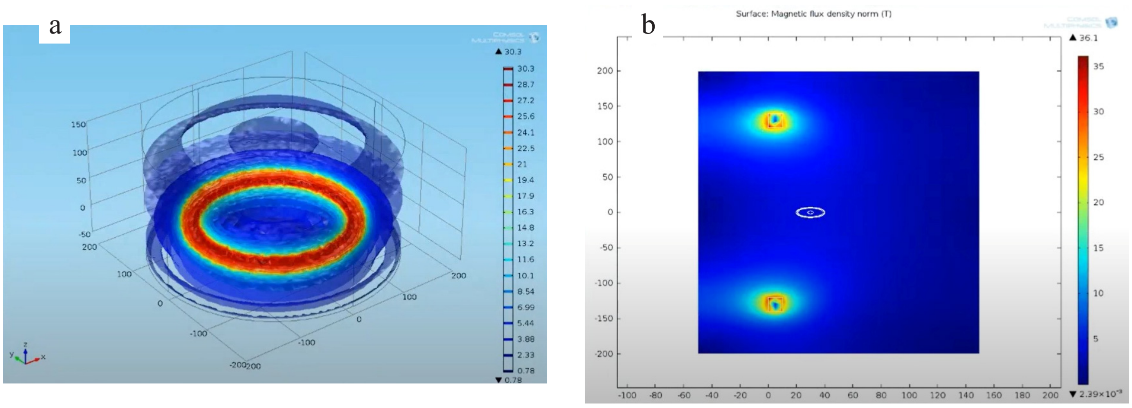

Fig. 3. *PET Scan Analysis Using COMSOL Simulation for Brain Tumour Treatment (a) Magnetic Flux Density distribution from the core source surround the brain of the human to be treated (b) Surface Magnetic Flux Energy norm for PET Device*

References

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2. *IAEA HUMAN HEALTH SERIES // Clinical PET/CT Atlas: A Casebook of Imaging in Oncology, 2015. – Vol. 1680. – P. 220.*

INVESTIGATION REMOVAL OF HEXAVALENT CHROMIUM Cr(VI) BY VARIOUS ADSORBENTS

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Abstract

As we know, hexavalent chromium Cr(VI) and its compounds have been widely used in many industrial activities [1–3]. It is also known as a toxic heavy metal, affecting adversely human and ecosystem health. Thus, researchers have made significant efforts to figure out innovative and economical ways to remove Cr(VI) in water [4–5]. In this research, the author modified and examined the Cr(VI) removal capacity by multiple adsorbents including commercial activated carbon (AC); raw rice husk (RH); treated rice husk by sorbic acid (TRH), and treated tea by sorbic acid (TT). In which, only AC and RH were untreated by any physical and chemical modifications. Meanwhile, TRH and TT were modified by sorbic acid under the same conditions. Major results reveal that raw rice husk contains many impurities since its removal capacity is unstable and unclear results. Inversely, other investigated materials well performed the removal Cr(VI) with remarkable presentations. Particularly, under the initial Cr(VI) concentration was 100 ppm, AC removed 72.48 % Cr(VI) in 4 hours; pH = 2; and under a 4 g/L dosage of AC. Similarly to removal conditions, 93.99 % Cr(VI) was removed by TRH; interestingly TT adsorbent eliminated 100 % Cr(VI). Some conclusions can withdraw from the study agricultural wastes like tea and rice husk are good at removing Cr(VI) after the modification by organic acid such as sorbic acid. Which is a regular component known as a food additive. The research also opens an innovative way of making friendly-economical adsorbents for current and further applications in environmental engineering.

Methods and materials

In this study, hexavalent chromium Cr(VI) was prepared from potassium dichromate in distilled water. pH solutions were adjusted by NaOH 0.1 M and HCl 0.1 M. To measure the residual Cr(VI) concentration in final solutions, the 1.5 Diphenylcarbohydrazide method was applied and checked by the DR2800 machine under 540 nm wavelength.

For modifying materials, rice husk and tea waste were cleaned with distilled water many times to remove complete impurities and then dried under 80 degrees overnight. The washed materials were soaked with sorbic acid 1M in an ultrasonic bath overnight. The next step is washing and drying the soaked materials by DI until the solutions reached pH neutral. The final adsorbents were stored in plastic bags to protect them from humidity and impurities in the air.

Results

Raw and modified adsorbents were investigated characteristics through FTIR and SEM analysis. From FTIR analysis, modified materials appeared in many new functional groups such as OH– at 3434 cm^{-1}; the strong band at 1620 cm^{-1} in the adsorbent determines the stretching vibration of the functional groups (COO–). Meanwhile, original materials and activate carbon have not exhibited these functional groups. For SEM investigation, raw rice husk (RH) does not have tiny holes on its surface. However, AC; TRH, and TT have rough surfaces and many tiny holes informing on their surface after modifications. These phenomena forecast these materials will increase their adsorption Cr(VI) capacity compared with raw rice husk. After experimental tests, these indicate that multiple studied adsorbents are remarkable performances in removing Cr(VI) under experimental conditions. They can be referenced as eco-friendly and economical materials for dealing with other heavy metals in upcoming research.