INTISARI

Pemodelan Desain Sistem Keselamatan Radiasi dan *Dose Treatment Planning* untuk Uji *In Vivo* BNCT Pada *Beam Port* Tembus Radial Reaktor Kartini Menggunakan Simulator MCNP-X

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Boron Neutron Capture Theraphy (BNCT) adalah metode radioterapi yang memanfaatkan interaksi boron-10 dan neutron termal yang menghasilkan partikel lithium dan partikel alfa yang digunakan untuk membunuh sel kanker. Bedasarkan BPKPOM, sebelum pengobatan diaplikasikan kepada manusia, dilakukan pengujian klinik dan non klinik. Non klinik meliputi uji *in vivo* dan *in vitro*. Dilakukan penelitian terkait simulasi uji *in vivo* pada organisme tikus yang telah diinjeksi dengan tumor paru-paru. Dibutuhkan jaminan agar para pekerja aman saat iradiasi. Peraturan BAPETEN telah menetapkan, dosis radiasi berada dibawah batas 20 mSv/ tahun. Sehingga diperlukan desain perisai radiasi.

Simulasi menggunakan program Monte Carlo N-Particle X (MCNP-X) Pemodelan uji in vivo menggunakan variasi kosentrasi boron yaitu 20, 25, 30, 35 dan 40 μg/g tumor. Bahan perisai radiasi yang digunakan adalah material parafin, alumunium, dan timbal.

Hasil penelitian menunjukkan, dibutuhkan 54 blok parafin dan 15 cm timbal untuk perisai radiasi ruang iradiasi kecil, dan 74 blok parafin serta 10 cm timbal untuk perisai radiasi ruang iradiasi besar agar pekerja dan lingkungan aman dari radiasi. Alternatif lain dilakukan untuk biaya yang lebih murah, dengan menggunakan 163 blok parafin dan 0,5 cm pb pada perisai radiasi ruang iradiasi kecil dan 176 blok parafin dan 0,5 cm pb pada perisai radiasi ruang iradiasi besar. Kosentrasi boron mempengaruhi laju dosis dan waktu iradiasi, saat kosentrasi boron bertambah maka laju dosis akan meningkat dan waktu iradiasi semakin singkat. Pada penelitian ini kosentrasi boron yang optimal yaitu 40 μg/g tumor, dengan laju dosis total 0,018 Gy/s dan waktu iradiasi 44 menit.

Kata kunci: Perisai Radiasi, Uji in vivo, BNCT, Kosentrasi boron

ABSTRACT

MODELING OF RADIATION SAFETY SYSTEM DESIGN AND DOSE TREATMENT PLANNING FOR IN VIVO TESTING BNCT ON RADIAL PIERCING BEAM PORT KARTINI REACTOR BY MCNP-X SIMULATOR

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Boron Neutron Capture Therapy (BNCT) is a radiotherapy method that utilizes the interaction of boron-10 and thermal neutrons that produce lithium particles and alpha particles used to kill cancer cells. Based on BPKPOM regulations, before treatment is done to humans, clinical and non-clinical testing are carried out. Non-clinics was included *In Vivo* and *In Vitro* tests. The Study was conducted regarding *In Vivo* test simulations towards rat organisms that had been injected with lung tumors. *In Vivo* test involves Kartini reactor as a source and guarantees that the workers and the environment are safe when the reactor operated. BAPETEN has established a regulation that radiation doses are within the radiation threshold of 20 mSv / year. So the shield's radiation design is needed.

The Simulation used the Monte-Carlo N-Particle X (MCNP-X) program. In Vivo test modeling used variation in boron concentrations of 20, 25, 30, 35 and 40 μg/ g tumors. The materials that being used in shielding's radiation are paraffin, aluminum and lead material.

The results of this study was indicated that it takes 54 paraffin blocks and 15 cm lead for small irradiation chamber of shield's radiation, and 74 paraffin blocks and 10 cm lead as radiation shields in large irradiated spaces so the workers and the environment are safe from radiation. Another option is being used to refer a lower cost, it used 163 paraffin blocks and 0.5 cm lead for shielding's radiation for small irradiation chambers and 176 paraffin blocks and 0.5 cm lead for radiation protection for large irradiated spaces. The concentration of boron will be affected the rate of dose and time of irradiation. The concentration of boron was increasing so the dose rate will increased, as well but the irradiation time will be shorter. In this study, the optimal boron's concentration was 40 μg / g tumor, with a 0.018 Gy / s of dose rate and 44 minutes of irradiation time.

Keywords: Radiation Shielding, In Vivo Testing, BNCT, Concentration of Boron