

INTISARI
PERANCANGAN SISTEM STERILISASI BERBASIS ULTRAVIOLET-C
MELALUI REKAYASA POSISI DAN UKURAN KACA FILM UNTUK
MERATAKAN SEBARAN RADIASI

Lovani Falendita Andri
18/425007/TK/46702

Diajukan kepada Departemen Teknik Nuklir dan Teknik Fisika Fakultas Teknik
Universitas Gadjah Mada pada tanggal 6 Januari 2023
untuk memenuhi sebagian persyaratan untuk memperoleh derajat
Sarjana Program Studi Teknik Fisika

INTISARI

Sebaran intensitas radiasi *ultraviolet* (UV) yang tidak merata pada sistem sterilisasi menyebabkan dosis UV yang diterima oleh objek sterilisasi menjadi tidak merata. Hal tersebut mengakibatkan proses sterilisasi kurang efektif. Kaca film memiliki kemampuan untuk menolak radiasi UV (*Ultraviolet Rejected* / UVR) lebih dari 99% sehingga dapat digunakan untuk menghalang radiasi UVC yang tidak diperlukan dalam proses sterilisasi dan objek sterilisasi akan menerima dosis secara merata. Penelitian ini telah merancang sistem sterilisasi berbasis UVC untuk panjang gelombang 254 nm dan 222 nm melalui rekayasa posisi dan ukuran kaca film yang efektif agar dapat menghasilkan sebaran radiasi UVC yang merata pada permukaan objek sterilisasi.

Perancangan posisi dan ukuran kaca film dilakukan dengan menganalisis sebaran intensitas radiasi UVC pada setiap titik uji objek sterilisasi. Tiga variabel bebas dalam perancangan pola posisi dan ukuran kaca film yaitu sebaran intensitas radiasi UVC yang diterima objek sterilisasi (I), jarak antara sumber UVC dengan objek sterilisasi (d), dan jarak antara dua sumber UVC terdekat (r). Terdapat empat analisis perancangan posisi dan ukuran kaca film berdasarkan variasi jarak antara dua sumber UVC terdekat yakni ketika nilai r sama dengan setengah kali nilai d , nilai r sama dengan nilai d , nilai r sama dengan dua kali nilai d , dan nilai r sama dengan 3,46 kali nilai d . Intensitas radiasi UVC pada titik uji objek sterilisasi diasumsikan mengikuti hukum kosinus Lambert.

Posisi kaca film yang menghasilkan sebaran intensitas radiasi UVC secara merata pada sistem sterilisasi berada di tengah dua sumber UVC terdekat dan tegak lurus terhadap arah sinar datang radiasi UVC. Ukuran kaca film yang menghasilkan sebaran intensitas radiasi UVC secara merata memiliki panjang yang sama dengan panjang sumber UVC, tebal minimal 0,2 cm, dan lebar kaca film yaitu minimal setengah dari jarak antara sumber UVC dengan objek sterilisasi.

Kata kunci: Sistem Sterilisasi, *Ultraviolet-C* (UVC), Kaca Film, Intensitas Radiasi.

Pembimbing Utama : Prof. Ir. Sunarno, M.Eng., Ph.D., IPU.

Pembimbing Pendamping : Dr. Nur Abdilllah Siddiq, S.T



ABSTRACT

DESIGN OF ULTRAVIOLET-C BASED STERILIZATION SYSTEM THROUGH POSITION AND SIZE ENGINEERING OF GLASS FILM TO EVEN UP RADIATION SPREAD

Lovani Falendita Andri
18/425007/TK/46702

Submitted to the Departement of Nuclear Engineering and Engineering Physics
Faculty of Engineering Universitas Gadjah Mada on January 6th, 2023
in partial fulfillment of the requirement for the Degree of
Bachelor of Engineering in Engineering Physics

ABSTRACT

The uneven distribution of ultraviolet (UV) radiation intensity in the sterilization system causes the UV dose received by the sterilizing object to be uneven. This resulted in the sterilization process being less effective. Window film can reject more than 99% UV radiation, so it can be used to block unnecessary UVC radiation in the sterilization process and the sterilized object will receive the dose evenly. This research has designed a UVC-based sterilization system for wavelengths of 254 nm and 222 nm by effectively engineering the position and size of window film to produce an even distribution of UVC radiation on the surface of the sterilizing object.

The design of the position and size of the window film is carried out by analyzing the distribution of UVC radiation intensity at each test point of the sterilization object. Three independent variables in designing the pattern of position and size of window film are the distribution of UVC radiation intensity received by the sterilizing object (I), the distance between the UVC source and the sterilizing object (d), and the distance between the two closest UVC sources (r). There are four design analyzes for the position and size of window film based on variations in the distance between the two closest UVC sources, namely when the r -value is equal to half the d -value, the r -value is equal to the d -value, the r -value is equal to twice the d -value, and the r -value is equal to 3.46 times of d -value. The UVC radiation intensity at the sterilized object's test point is assumed to follow Lambert's cosine law.

The position of the window film that produces an even distribution of UVC radiation intensity in the sterilization system is in the middle of the two nearest UVC sources and is perpendicular to the direction of incident UVC radiation. The size of the window film that produces an even distribution of UVC radiation intensity has the same length as the length of the UVC source, a minimum thickness of 0.2 cm, and the width of the window film, which is at least half the distance between the UVC source and the object of sterilization.

Keywords: *Sterilization System, Ultraviolet-C (UVC), Window Film, Radiation Intensity.*

Supervisor : Prof. Ir. Sunarno, M.Eng., Ph.D., IPU.

Co-supervisor : Dr. Nur Abdilllah Siddiq, S.T

