

RINGKASAN

PENGARUH RADIASI CAHAYA LASER HELIUM-NEON (He-Ne)
PADA FRAGMEN DNA 1784 pb IN VITRO

Djajadi

Laser adalah singkatan dari *light amplification by stimulated emission of radiation*. Laser He-Ne mempunyai keluaran berkas cahaya sejajar, monokromatis, dan sefase (koheren) yang dapat dilihat serta panjang gelombang elektromagnetiknya adalah 632,8 nm. Gelombang elektromagnetik merambat dengan membawa paket-paket energi berupa foton.

Cahaya laser He-Ne dapat dimanfaatkan untuk membuat gambar holografis dan gambar tersebut dapat dilihat secara 3 dimensi. Gambar holografis dimanfaatkan untuk mempermudah pembedahan di rumah sakit karena bagian tubuh yang akan dioperasi dapat dilihat secara 3 dimensi.

Sewaktu perekaman gambar holografis perlu pemaparan cahaya laser He-Ne pada tubuh sehingga terjadi interaksi foton cahaya laser He-Ne dan jaringan tubuh. Jaringan tubuh terdiri dari sel-sel dan dalam sel terdapat materi yang tergolong penting bernama DNA (*deoxyribo nucleic acid*).

DNA berbentuk untai ganda yang merupakan *double helix*. Gugus gula *deoxyribose* dan gugus *phosphate* membentuk bagian luar DNA sedangkan bagian dalam DNA adalah pasangan basa *adenine-thymine* atau *cytosine-guanine*.

Untuk mengetahui apakah semata-mata DNA terusik oleh cahaya laser He-Ne maka perlu penelitian dengan DNA in vitro yaitu DNA diluar sel didalam larutan TE. TE adalah suatu *buffer* yang terdiri atas larutan 0,384 g *tris-maze base* dan 0.0093 g EDTA dalam 260 ml aquades sedangkan EDTA adalah *ethylene diamine tetraacetic acid*.

Isolasi DNA dilakukan dan *Endomycopsis fibuligera* ITB R.cc 64. Hasil isolasi DNA digunakan sebagai cetakan / templat untuk penggandaan dengan alat PCR (*polymerase chain reaction*) yang pemicunya primer P₁ dan P₂ tertentu sehingga hasil PCR adalah fragmen DNA 1784 pb (pasang basa).

Fragmen DNA 1784 pb dalam larutan TE sebagian dipapar dengan cahaya laser He-Ne dengan energi pemaparan tertentu.

Fragmen DNA 1784 pb yang terpapar dan yang tidak terpapar oleh cahaya laser He-Ne dilakukan uji dengan alat elektroforesis. Hasil eksperimen menunjukkan bahwa pemaparan dengan cahaya laser He-Ne tidak memutus fragmen DNA 1784 pb yang sesuai dengan perhitungan secara teoritis bahwa energi foton laser He-Ne tidak mampu memutus untai DNA.

Fragmen DNA 1784 pb yang terpapar dan yang tidak terpapar oleh cahaya laser He-Ne dilacak urutan basanya (*sequencing*). Urutan basa fragmen DNA 1784 pb yang terpapar dan tidak terpapar cahaya laser He-Ne dibandingkan. Kemudian a). probabilitas basa yang berubah dihitung secara statistis dengan pendekatan distribusi Poisson, b). proporsi basa yang berubah pada pengamatan eksperimen dihitung, c). andaikan seluruh foton yang memapar memutus basa, maka proporsi basa yang berubah dapat ditentukan, d). kalau memperhatikan data sekunder maka ada mutasi genetik karena perubahan struktur molekuler materi genetik disebabkan

oleh sinar kosmik, dan e). hasil perhitungan teoritis menunjukkan energi foton laser He-Ne tidak mampu memutus basa, oleh sebab itu berdasarkan *a*, *b*, *c*, *d*, dan *e* tersebut dapat dibahas bahwa cahaya laser He-Ne tidak mampu memutus gugus basa pada fragmen DNA 1784 pb.

Jadi hasil penelitian dapat menunjukkan bahwa cahaya laser He-Ne tidak mampu mengusik fragmen DNA 1784 ph.

Kata kunci : Fragmen DNA, Laser He-Ne. Holografis, Elektroforesis, dan *Sequencing*



SUMMARY

**THE EFFECTS OF HELIUM-NEON (He-Ne) LASER
ON DNA 1784 pb IN VITRO FRAGMENTS**

Djajadi

Laser is short for *light amplification by stimulated emission of radiation*. He-Ne laser produces visible, monochromatic and coherent parallel beams of light, with electromagnetic wave lengths of 632,8 nm. The electromagnetic waves are extended in range by carrying packages of photon energy.

He-Ne laser beams are utilized to generate holographs showing a three-dimensional image of an object. The holographical image is utilized to simplify surgery in a hospital operating room since the part of the body that is going to be operated can be seen three-dimensionally.

The He-Ne laser beams should be exposed on the body during the holographical scanning and so produce interaction between photons of the He-Ne laser beams and body tissues. A body tissue consists of cells and in these cells there is somewhat an important substance called DNA (*deoxyribonucleic acid*).

A deoxyribonucleic acid is in the form of a twisted double strand or double helix. The deoxyribose sugar nucleotide and phosphate group form the outer part of a DNA. The inner part of a DNA consists of complementary bases, that is, nucleotide containing adenine which are paired with nucleotide containing thymine and nucleotide containing cytosine which are paired with nucleotide containing guanine.

A research on DNA in vitro, that is, DNAs outside the cells in TE solution was conducted to find out whether the He-Ne laser beams merely perturbed the DNAs. TE is a buffer comprising 0,384 g of trismaze base and 0,0093 g of EDTA (ethylene diamine tetra acetic acid) solution in 260 ml aquades.

Isolating DNA from *Endomycopsis fibuligera* ITB R.cc 64 was conducted. The results of the DNA isolation were used as duplicating templates with PCR (polymerase chain reaction) equipment triggering specific P₁ and P₂ primers, in order that the PCR results were DNA 1784 fragments of pairing bases (pb).

A test using an electrophoresis apparatus was carried out to examine the exposed and non exposed DNA 1784 pb fragments generated by the He-Ne laser beams. The results of the experiment showed that the He-Ne laser beam exposure did not cut the DNA 1784 pb fragments. This was appropriate with the theoretical estimation that photon energy of He-Ne laser is incapable of cutting the DNA 1784 pb fragments.

The sequencing bases of the exposed and non exposed DNA 1784 pb fragments generated by the He-Ne laser beams were traced and compared. Afterward, a) the probability of the modified bases was estimated statistically by using Poisson's distribution approach, b) the proportion of the modified bases during the experiment study was estimated, c) if the entire exposed photons cut the bases, then, the proportion of the modified bases could be estimated, d) the secondary data showed that there was a genetic mutation; since changes of molecular structure of genetic substance were generated by cosmic rays, e) the results of theoretical estimation showed that the photon energy of He-Ne laser was incapable of cutting the bases. Therefore, based on a, b, c, d, and e, it could be argued that He-Ne laser was incapable of cutting the bases of DNA 1784 pb fragments.

Hence, the results of the research showed that He-Ne laser beams could not perturbed DNA 1784 pb fragments.

Key words: DNA fragments, He-Ne laser, Holographical, Electrophoresis, and Sequencing.

ABSTRACT

Title : The Influence of Laser Helium-Neon on Fragment DNA 1784 Pairs of Base in Vitro

Djajadi

This research observed the influence of laser helium-neon (He-Ne) radiation on fragment deoxyribonucleic acid (DNA) 1784 pairs of base. Fragment DNA in solution TE. TE stands for tris EDTA. Buffer TE consists of 0,384 g tris base and 0,0093 g EDTA in 260 ml aquades and EDTA was ethylene diamine tetraacetic acid. The probability of influence lies on the cutting of fragment DNA and the change of order of base fragment DNA.

The research was conducted in five steps respectively the isolation of DNA from *Endomycopsis fibuligera* ITB R.cc.64 to find the followings template for amplification DNA 1784 pairs of base, the amplification of fragment DNA 1784 pairs of base from gene glucoamylase of *Endomycopsis fibuligera* ITB R.cc.64 by using instrument Polymerase Chain Reaction (PCR) Thermal Analyzer Bio-rad USA and the amplification was conducted through predenaturation on 95°C for 5 minutes and then continued with denaturation on 95°C for 1 minute; annealing on 55°C for 1 minute; extention on 72°C for 2 minutes with the number of cycle 30 times with the addition of extention on 72°C for 5 minutes; radiation He-Ne on fragment DNA 1784 pairs of base with the intensity radiation 0,9 joule/m² which was the optimum intensity on holographic film with the trade mark Kodak Spectroscopic Plate Type 649-F; 2% agarose to detect the separation fragment DNA. sequencing DNA by using Sanger method and its instrument was ABI PRISM 377 Sequencer with reagent "Bigdye Terminator" V2.0 to observe the structure of order of pairs of base fragment DNA. The conclusion of the experiment result involved statistical method, that is, Poisson distribution estimation.

The laboratory experimental research showed primary data that all tapes of fragment DNA on the electrophoresis photo gel agarose 2% existed on the horizontal line and the probability of mutation of pairs base fragment DNA was caused by cosmic rays. The secondary data was about 2% of genetic mutation was caused banyak the change of molecule structure of genetic material caused by cosmic ray.

The result of experiment showed that there was no influence of laser radiation He-Ne on the fragment DNA 1784 pairs of base in vitro.

Key word : fragment DNA, Laser He-Ne, Holographic, Electrophoresis, and Sequencing.