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THE 11TH INTERNATIONAL INNOVATION, INVENTION & DESIGN COMPETITION INDES 2022

EXTENDED ABSTRACTS BOOK



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PRIMER DESIGN FOR THE MOST INFECTIOUS TYPE OF HIV-1 IN INDONESIA

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ABSTRACT

Indonesia is one of the countries with a high growth rate of HIV cases globally. AIDS-related deaths in Indonesia have not fallen and increased significantly since 2010. HIV infection rates remain high and rising in key affected populations. The incidence of HIV is growing steadily in Indonesia, with over 670,000 HIV-infected individuals recorded in 2015. Based on the Indonesian Health Profile data, HIV-positive adult reports remain high. The Indonesian Pediatric Society (IPS) reported that 1,188 Indonesian children were HIV-positive in 2022. Data were collected over the period January-June 2022. HIV is a massive virus that weakens immunity. Therefore, a fast and accurate method is needed to detect HIV so that it can be detected early. One fast and accurate method of detecting is using the PCR (Polymerase Chain Reaction) method, where a primer is needed. Therefore, in this innovation, we are designing a pair of primers targeting the HIV-1 CRF01_AE subtype, which is selected after analyzing the most common subtypes in Indonesia using sequence references from the LANL gene bank (Los Alamos National Library) to determine subtypes. The primer design has met the requirements, having 40-60% GC content, a melting temperature (Tm) of 45-65C, and no mono and dinucleotide repetitive sequences. From the results of this primer design, a marketable HIV detection PCR kit can be made, especially for the HIV-1 CRF01_AE subtype.

Keywords: HIV, HIV-1, CRF01_AE, detection, primer design.

1. INTRODUCTION

Human Immunodeficiency Virus (HIV) is a type of virus that infects white blood cells, which causes a decrease in human immunity. The prevalence of the global HIV epidemic reached 37.7 million people worldwide in 2020, and there were 1.5 million newly infected people with HIV in 2020 and 1.1 million deaths from AIDS. The cumulative cases of HIV/AIDS in Indonesia are 558.618 (Andrianto et al., 2021). In 2019, 50,282 cases of HIV were diagnosed in Indonesia, and cases were reported in 33 of 34 provinces. East Java, Jakarta, West Java, Central Java, Papua, North Sumatra, Bali, Banten, South Sulawesi, and East Kalimantan were the 10 provinces with the highest number of reported cases of HIV/AIDS, but those reports were not descriptive and did not address the social stigma faced by the 360,000 out of 540,000 PLHA who knew their status in 2020 (Sadarang, 2022). PCR is one of the widely used amplification techniques due to its high sensitivity and good reproducibility. The efficacy of PCR is based on its ability to amplify a specific DNA segment through a pair of primers (Li, 2019). PCR can



using PCR. Primers can later be marketed in the form of PCR-HIV kits that various laboratories and hospitals can use to detect HIV.

2. FINDINGS

An early detection of HIV is an important step in reducing transmission and increasing the success of HIV treatment. The sooner HIV is detected, the sooner treatment can be carried out so that this infection can be controlled and does not develop into AIDS. We, therefore, designed primers for use in PCR assays targeting the HIV-1 subtype CRF01_AE. Primers were designed and a pair of forward and reverse primers were obtained. Forward primer CACAAACAATGCCGAGACCAT and Reverse primer ATTGCTTGTCCTACTCCCTGC with a length of 21 each. The results of the analysis on the forward primer showed that the GC is 48% and Tm is 52.4°C and the reverse primer showed that the GC is 54.4% and Tm is 54.4°C. The primer design has met the requirements, having 40-60% GC content, a melting temperature (Tm) of 45-65C, and no mono and dinucleotide repetitive sequences.

3. METHODOLOGY

The findings started from an analysis of the most HIV subtypes in Indonesia using a sequence reference from the LANL gene bank (Los Alamos National Library) and selected subtype CRF01_AE from HIV-1. After that, the gene sequences were taken from the NCBI (National Center for Biotechnology Information). The next step that has been taken is that the primers are designed at NCBI and analyzed for their quality using Oligo Calc: Oligonucleotide Properties Calculator.

4. CONCLUSION

From the results of this primer design, a marketable HIV detection PCR kit can be made, especially for the HIV-1 CRF01_AE subtype. The primer design pair can be used to amplify the target region of the Indonesian HIV-1 subtype integrase gene CRF01_AE.

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