ABSTRACT

The growing demand for high-capacity and long-distance data transmission has made Dense *Wavelength division multiplexing* (DWDM) a vital technology in modern optical communication systems. However, DWDM systems face challenges such as signal attenuation and dispersion over long distances. This study aims to analyze the performance of a soliton-based DWDM system using a hybrid optical amplifier configuration combining *Raman optical amplifier* (ROA) and *Erbium-doped fiber amplifier* (EDFA). Two amplifier placements are evaluated: ROA as a booster amplifier and ROA as an inline amplifier. Additionally, the effect of implementing *Dispersion compensation fiber* (DCF) is examined to improve signal quality. Simulations were carried out using OptiSystem 7.0 software, with laser input power varying from -8 dBm to 8 dBm and optical fiber lengths of 30 km, 50 km, and 100 km. The results show that placing ROA as a booster amplifier provides better system performance, especially when combined with DCF, achieving a *bit error rate* (BER) as low as 10^{-36}. In contrast, using ROA as an inline amplifier results in decreased performance at low power and long distances. In conclusion, the ROA *booster amplifier* configuration with DCF is highly recommended for long-distance DWDM systems. The use of soliton pulses also effectively reduces dispersion and maintains signal stability in optical transmission.

Keywords: *Bit error rate, dense wavelength division multiplexing, erbium doped fiber amplifier, raman optical amplifier, HYBRID,dispersion compensation fiber*