We report the characterization of 1,8-naphthalene benzimidazole comprising carboxyl group. We have fabricated dye-sensitized nanocrystalline TiO$_2$ solar cell (DSSC) based on naphthalene benzimidazole dye. The device structure is FTO/nc-TiO$_2$/Dye/I$^-$/I$_3^-$/Pt/FTO. We calculated the $E_{\text{HOMO}}$ and $E_{\text{LUMO}}$ levels of this new dye by using cyclic voltammetry measurement. The $E_{\text{LUMO}}$ level of naphthalene benzimidazole is 3.2 eV. This value is higher than the conduction band of TiO$_2$. Electrons can be injected to the conduction band of TiO$_2$. The current-voltage ($I$-$V$) characteristic of cell was measured under simulated AM 1.5 illumination (100 mW/cm$^2$). We obtained the open circuit voltage; $V_{\text{oc}} = 0.344$ V, short circuit current density; $I_{\text{sc}} = 5.93$ mA cm$^{-2}$, filling factor; $FF = 0.45$, power conversion efficiency; $\eta = 0.91\%$.