The present study deals with the production of genistein by β-glucosidase from *A. oryzae* Isl-9 under submerged fermentation and immobilized on Al_2O_3 nanocrystals which were synthesized by using leaf extracts of *Cajanus cajan* L. Millsp. The dried semi-amorphous leaf samples were used to prepare leaf extract at 65°C for 30 min. For enzyme production under submerged fermentation, 50 ml of media at pH 8.6 with 2 ml of inoculum was incubated at 30°C (160 rpm) for 72 h by optimized parameters, provided the β-glucosidase activity (2.38±0.002 U/mg). The Al_2O_3 nanocrystals were synthesized by adding 30 mM Al_2NO_3 to 18.75 ml peptone saline with NaOH at 60°C for 75 min which enhanced the β-glucosidase specific activity (5.64±0.07 U/mg) when immobilized. Genistein by biotransformation obtained using both free (0.67±0.42 mg/ml) and Al_2O_3 immobilized β-glucosidase (1.3±0.66 mg/ml) with 2.5 ml of substrate and 1 ml of enzyme for 48 h. The UV-VIS spectra obtained for leaf extract, free β-glucosidase, Al_2O_3 nanocrystals and Al_2O_3 immobilized β-glucosidase were at 225, 235, 210 and 300 nm. Bands were obtained at 500-750 cm^{-1} that showed the Al_2O_3 nanocrystals production in FTIR analysis by change in functional groups of free and Al_2O_3 immobilized β-glucosidase. In XRD analysis, peaks depicted the crystalline structure of Al_2O_3 nanocrystals ranging from 10-50°. The size of nanocrystals was confirmed by using different magnifications (1.01, 2.00, 3.00, 5.00, 7.02, and 10 K X) of SEM images obtained. For zeta potential measurements, peak was obtained at -21.0 mV and the size distribution analysis was attained as 206.4 d.nm at an intensity of 16.2%. These results are highly significant as according to analysis, Al_2O_3 immobilized β-glucosidase produced biocompatible isoflavone compounds especially genistein which used in pharmaceutical industries.