The main objective of the study is to develop Specific, Robust, Rugged, Simple, Sensitive, Cost effective and Rapid HPLC methods for the selected compounds N-Methyl fluoxetine oxalate, Etoricoxib, Prasugrel hydrochloride and Pioglitazone hydrochloride. To attain so, it is required to have sophisticated analytical techniques to separate and quantify the impurities present in the drug intermediate and substances. So an analytical tool “Liquid Chromatography (LC), in other words it is called High Performance Liquid Chromatography (HPLC)” is choosen to separate and quantify the impurities.

Upon thorough literature survey it has been observed that there is no simple stability indicating validated HPLC methods for the quantification of selected process related impurities and degradation impurities formed during the manufacturing, handling and storage of N-methyl fluoxetine oxalate, Etoricoxib, Prasugrel hydrochloride and Pioglitazone hydrochloride in drug substance. In view of this, cost effective, simple and sensitive HPLC methods were developed, optimized and subjected for validation for the determination of the process related purities and degradation products of the selected compounds. All the developed methods were validated as per the ICH Q2 Guideline (Validation of analytical procedures).

Specificity of the analytical method indicates the resolution of the main substance with its impurities and degradation products of the principle compound. All the developed methods specificity is carried out in the presence of its impurities. The resolution between the compound and all impurities has been found to be greater than 1.5 in all the developed methods. Correlation coefficient ($R^2$) has been found to be more than 0.98 for main compound and all its impurities. The %RSD for the main compound response and retention time has been found to be below 1.5. The %RSD
for all the impurities response and retention time was found to be below 10.0. Recovery study has been conducted to evaluate the accuracy of the methods by means of spiking the known amount of impurities to the standard solutions. The % recovery has been determined by injecting the standard solutions of impurities, standard preparations and standard spiked with the impurities. The percentage recovery has been calculated and found to be well within the acceptable range. The % recovery for all the impurities has been found to be in between 90 to 110%. Sensitivity of the method has been determined to establish the limit of quantitation and limit of determination for the main compound and all impurities. All the methods were found to be sensitive with the lower limit of quantification values and were reproducible at LOQ level. Robustness of the developed methods has been verified by deliberately altering the method parameters like flow rate, composition of mobile phase, pH of the buffer and column oven temperature. The ruggedness of the developed methods was carried out by conducting the precision on different systems, different columns, different analyst and different days. All the methods have been found to be rugged and robust. The % RSD of the response has been found to be below 10.

The stability indicating nature of the methods has been evaluated by conducting forced degradation study by subjecting the main compound to degradation conditions of hydrolysis (acid and base), oxidation, photolysis and thermal degradation. Degradation study was performed on principle concentration of the compound in diluent. Neutral, acid hydrolysis, base hydrolysis and oxidation study was carried out by using diluent, 2mL/5 mL of 1N hydrochloric acid, 2mL/5 mL of 1N sodium hydroxide and 2 mL of 50 % hydrogen peroxide solutions, respectively. These solutions were prepared and were heated in water bath for 0.5 hr, 1 hr, 1.5 hr etc. Photolytic and Thermal degradation was carried out on drug substance by exposing it
separately on short wavelength light (254 nm) and heat. Samples were withdrawn at appropriate time and subjected to analysis. All the impurities and degradation products were separated with appropriate resolution of more than 1.5.