Nowadays, the formation of a tumor as a result of the accumulation of genetic and epigenetic mutations is one of the most serious diseases that affects many people. Therefore, there is a great interest in both creating extremely sensitive and specific drugs that could be used in cancer therapy and in understanding of metastasis and growth promotion mechanisms in tumors. Studies have shown that a deficiency or overexpression of certain enzymes (e.g., kinases) contribute to the development of tumors.

Kinases catalyze phosphorylation reaction in which the terminal phosphate fragment of ATP is transferred to the hydroxyl group of the target amino acid residue such as: serine, threonine, or tyrosine. This leads to activation of a signaling pathway inside the cell, and consequently to induction of the expression of genes involved in cell proliferation, migration, adhesion, differentiation and cell survival, as well as DNA repair. Deregulation of protein kinases function is recognized in various type of malignant diseases, i.a. non - small cell lung cancer (NSCLC). According to the World Health Organization lung cancer is the most common type of tumor which is leading cause of death in men population and the second leading cause of death in woman population. NSCLC accounts for approximately 85% of all lung cancers. Because of the overexpression of the EGFR, which is receptor tyrosine kinase, in NSCLC target therapy in treat this type of cancer, is applied. Although, this target therapy, by using gefitinib and erlotinib, indicate good results in cancer therapy, these drugs show low specificity and expose the patient to many side effects e.g., skin rash and diarrhea. Moreover, in many cases no response to the therapy, has been achieved. Thus, it is necessary to still develop targeted therapy in NSCLC. The good direction for achieving this goal seems to be designing effective carriers, which will be used for delivering gefitinib and erlotinib into the cancer cell.

The first aim of the research project is determination of vibrational structure of the investigated compounds in the solid state and in solution (H_2O).

The second aim is characterization of adsorption process of the aforementioned kinase inhibitors onto colloidal nanoparticles, prepared under controlled conditions, and changes in this process upon measurements conditions (pH of a solution, concentration of the investigated compound). The obtained results will indicate these nanoparticles which are the most stable and give the most effective distribution for the investigated drugs in the appropriate conditions. These nanocarriers will be used in the next stage of the project.

The third aim of the project is determination of the cytotoxicity of the selected nanocariers and of the drugs effectively distributed onto the nanocarriers in the appropriate conditions (characterized in the second aim of the project) onto three selected cell lines: lung epithelial cell line (normal/reference cell line), non - small cell lung carcinoma and its metastatic side (lymph node).

The obtained results will provide complex information about the structure, the metabolism, the distribution in cancer cell, and the cell - drug interaction of the gefitinib and erlotinib. Determination of the molecular and the geometric structure of the aforementioned drugs will help to get information that could affect their biological activity. Moreover, the results will allow to verify and understand the drug distribution onto the used nanoparticles upon various conditions (pH, concentration of sample) and characterize the influence of the drug (distributed onto the colloidal nanocarrier) interaction in *in vitro* model. Such information may be of a great importance for increase effectiveness of the target therapy applied in NSCLC.