Praca dyplomowa inżynierska

Analysis of an active agent modified release mechanisms in dispersed systems

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Introduction

Modified release systems of active agents are defined as systems providing means to modify rate, profile or place where the release occurs, in comparison to conventional dosage forms of drugs administered over the same route. Among systems with modified profile of release delayed, sustained and pulsatile release systems can be distinguished. Dispersed systems, like emulsions, are commonly employed in obtaining modified release drugs. In majority of drug release systems, the release is limited by mechanisms like dissolution, osmosis, diffusion or chemical reaction. They can take place simultaneously or at different stages of a release process.

Aim and scope of thesis

The thesis is aimed at presenting key aspects of drug release in dispersed systems and an overview of available approaches to predict its release profile with simple mathematical models and computer-based modeling – *in silico*.
The scope of thesis includes:

- Identification and description of key dispersed systems used in modified release drug systems and main release mechanisms
- Overview of basic mathematical models used for preliminary estimation of release rate

Characteristics of modified release system

Multiple emulsions are an example of a dispersed system with broad application in modified release drugs. In this case, two different mass transfer mechanisms can be involved in release – simple or facilitated diffusion or fragmentation. Modified release systems can be classified according to the process limiting the release. Dissolution-, osmotically- and diffusion-controlled systems are among the examples.

Mathematical and computer modeling

Many theoretical models attempt to describe the release profile of an active agents by using simple mathematical equations. Examples include a zero order,a first order or the Higuchi's model. However, they do not take into consideration the actual release process that takes place in human organism. Thus, obtained results are insufficient and more advanced approach, *in silico* modeling, is required to be introduced.

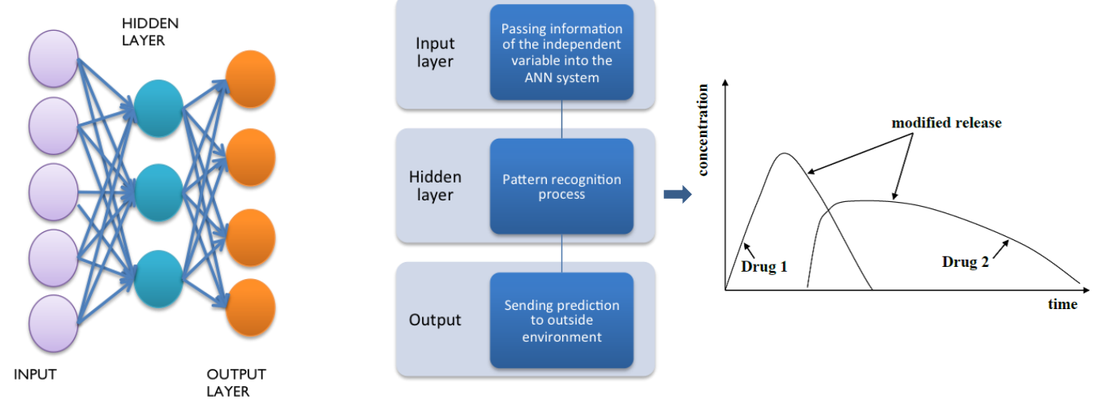

Fig.1. A working scheme of artificial neural network used in mathematical modeling of a drug release (Yee and Wei, 2012)

In silico is a computer-aided modeling employed for estimating certain parameters crucial for describing the route of a drug through the human body. Quantitative Structure-Activity Relationship (QSAR) models are mathematical models that attempt to relate structure-derived features of a compound to its biological or physicochemical activity. The main assumption is of QSAR is that compounds of similar structure perform similar activities. Artificial neural networks are an example of multivariate analysis used in QSAR modeling.

Conclusion

Two different approaches can be used to predict the release rate of a active agents. In order to have basic estimates of the release profile, one can use simple mathematical models that do not take into account the actual conditions present in human organism. The basic estimations are obtained with the Higuchi model, a zero order model, a first order model and the Korsenmeyer-Peppas model. Another way to describe modified release is to apply advanced computer-aided modeling – *in silico*. In addition to cost and time savings, they provide more reliable results in comparison to *in vitro* approach.