

# Phosphatidylcholine with conjugated linoleic acid in fabrication of custom-designed lipid nanocarriers

Kazimiera A. Wilk<sup>1\*</sup>, Agata Pucek<sup>1</sup>, Natalia Niezgoda<sup>2</sup>, Julita Kulbacka<sup>3</sup>, Czesław Wawrzyńczyk<sup>2</sup>

<sup>1</sup>Department of Organic and Pharmaceutical Technology, Faculty of Chemistry, Wrocław University of Science and Technology, Wrocław, Poland

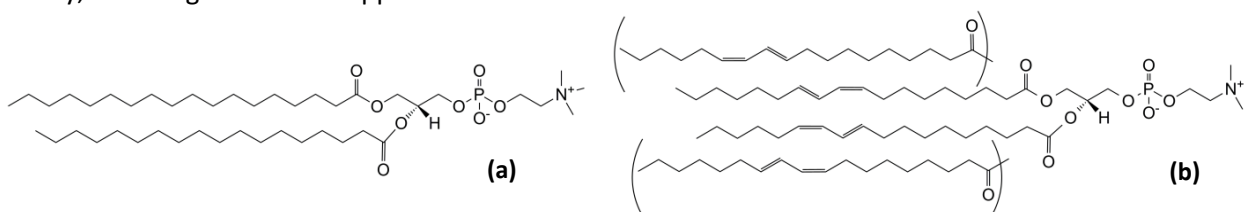
<sup>2</sup>Department of Chemistry, Wrocław University of Environmental and Life Sciences, Wrocław, Poland

<sup>3</sup>Department of Medical Biochemistry, Medical University of Wrocław, Wrocław, Poland

\*e-mail: kazimiera.wilk@pwr.edu.pl

Exploration of novel lipid-based formulations has been an aim for researchers over the last decades. Lipid nanoparticles have been extensively studied as bioactive agent carriers in the biochemical and biotechnological fields. In our studies we have provided properties of two different types of lipid nanocarriers, i.e., solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC) prepared via high pressure homogenization method. The choice of surfactants in the structural design of the lipid nanoparticles is one of the most significant approaches to achieve nanosystems with desirable parameters, that acquire both good stability and requested physical state.

The present work has been carried out to explore the potential for fabrication of stable and nearly monodisperse lipid nanoparticles stabilized by two of recently synthesized phosphatidylcholine-type surfactants, i.e., 1,2-distearoyl-sn-glycero-3-phosphocholine (Fig.1a) and 1,2-di(conjugated)linoleoyl-sn-glycero-3-phosphocholine (Fig.1b), which are potential lipid prodrugs. The sizes of the studied nanosystems (about 100-200nm) along with the size distribution (below 0.3) were determined by dynamic light scattering (DLS), while shape and morphology – by atomic force microscopy (AFM). The physical state of the studied nanoparticles was characterized by differential scanning calorimetry (DSC) and X-ray diffraction (XRD). The NLCs had a less ordered crystalline structure than the SLNs, which is conferred by the inclusion of the liquid lipid; in result, they had lower values for phase transition temperature and melting enthalpy. The delivery efficiency *in vitro* was evaluated with human cancer cell lines – epidermoid carcinoma (A431) and skin melanoma (MeWo) compared to normal human keratinocytes (HaCaT). The *in vitro* cytotoxicity evaluation of the studied nanosystems was performed after 24 and 48 hours using the MTT assay. The obtained results indicated an increased cytotoxicity of nanocarriers against cancer cells in relation to free phospholipids. The most significant antiproliferative effect was observed in the case of nanocarriers where the molar ratio of phospholipid to T80 was 1:1 and 3:1. Additionally, the nanocarriers based on 1,2-distearoyl-sn-glycero-3-phosphocholine revealed not significantly increased cytotoxic effect in melanoma cells. The most safe were the NLC nanocarriers where the molar ratio of phospholipid to T80 was 5:1. Our results give new insights into the lipid nanoparticles containing phosphatidylcholine-type surfactants and may serve as guidelines for design and preparation of new delivery systems for pharmacological activity, including anti-cancer applications.



**Figure 1** Structures of the studied phosphatidylcholine-type surfactants.

## Acknowledgements

This work has been supported by a statutory activity subsidy from the Polish Ministry of Science and Higher Education for the Faculty of Chemistry of Wrocław University of Science and Technology.