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A new precursor for redox- triggered drug delivery vesicles selective to cancer cells

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Drug delivery systems are one of the biggest challenges and emerging fields in the world nowadays. There is a wide interest in developing an efficient method that will be able to transport a biologically active material to a desired location, and then releasing it using a simple process. From the different approaches that tried to overcome the different developing challenges only four nanoparticle-based drug delivery platforms were approved by the Food and Drug Administration (FDA). We present here a novel design of a smart drug delivery liposomes based on the use of redox active phospholipids. For the first time a simple one step scalable non-enzymatic synthesis of ferrocene bearing phospholipids (redox active phospholipids) is presented. These redox active phospholipids can be self-assembled into vesicles that securely encapsulate different agents such as toxic drugs (doxorubicin). The redox triggering is very sensitive to small and local changes; therefore, it can be applied without affecting other species in the environment as opposed to pH, temperature, ultrasound and photochemistry changes. The system was characterized using advanced methods such as SECM, TEM, DLS and immunoarray fluorescent imaging. Furthermore, when loading the vesicles with anti-cancer medicine and exposing them to live cells we show that the redox induced payload mechanism is fully functional. Furthermore, The redox triggering of such liposomes is selective to cancer cells, leaving non-cancerous cells unharmed. This work which lay the foundation for several cancer treatments and can serve as a platform for future delivery vesicles.