Lipid-based soft nanovectors are widely used for delivery purposes in many fields of applications. Although it is generally considered a class of molecules with superior biocompatibility, in recent times researchers have expressed concerns with regards to the sustainability of preparation procedures. In particular, when large-scale production is involved, as in the case of agro-nanotechnology applications, this becomes a most pressing issue. A relevant application in this field is the delivery of bioactive compounds to rooting recalcitrant species, since some of these plants are true resources for healthy diets and local economies. Among agrochemicals there is a class of natural phytohormones (auxins) known for their ability to stimulate root growth, which use is made difficult by their poor water-solubility and scarce bioavailability. We prepared green novel nanoformulations employing lipids extracted from natural sources (agricultural waste), we loaded them with two auxins, and engineered them with small amounts of purified phospholipids, i.e. DOPC and DOPE. Then we carried out advanced structural characterization of their supramolecular arrangement by high-resolution techniques, such as synchrotron SAXS and USAXS. We covered a wide q-range, i.e. $3x10^{-4}$ Å $^{-1}$- 0.7 Å $^{-1}$, which allowed to explore the different size populations and phases in our samples and extrapolate robust models. Data analysis showed that two different kind of aggregates, lamellar vesicles and hexagonal mesophases, were obtained depending on phospholipid composition, DOPC or DOPE respectively. In both cases the fitting results showed that two, or sometimes three, coexisting populations of aggregates contributed to the scattering intensity. For DOPC samples uni- and bilamellar vesicles dominated the signal in all the investigated q domain (Fig.1). The scattering signal of the PE series was dominated by various contributions in the different q regions. Specifically, three distinct families were identified, i.e. small and large hexosomes, the latter dominant at low q, and vesicles dominant at high q (Fig.2). These results, complemented by other techniques such as SANS and Cryo-TEM, allowed us to finely investigate such complex samples and, we believe, to meaningfully contribute on the study of natural-derived unconventional soft matter systems for delivery purposes. The published results can be found as Clemente et al., *ACS Sustainable Chem. Eng.* 2019, 7, 15, 12838-12846.

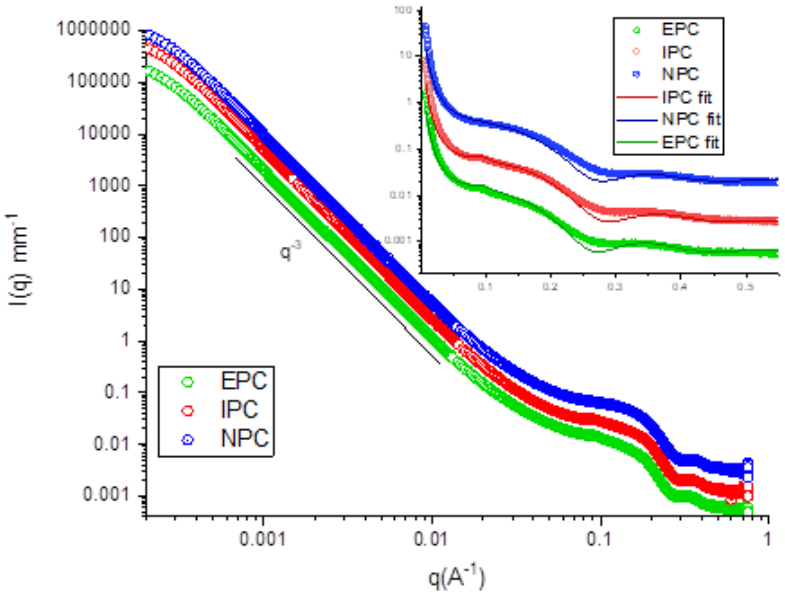
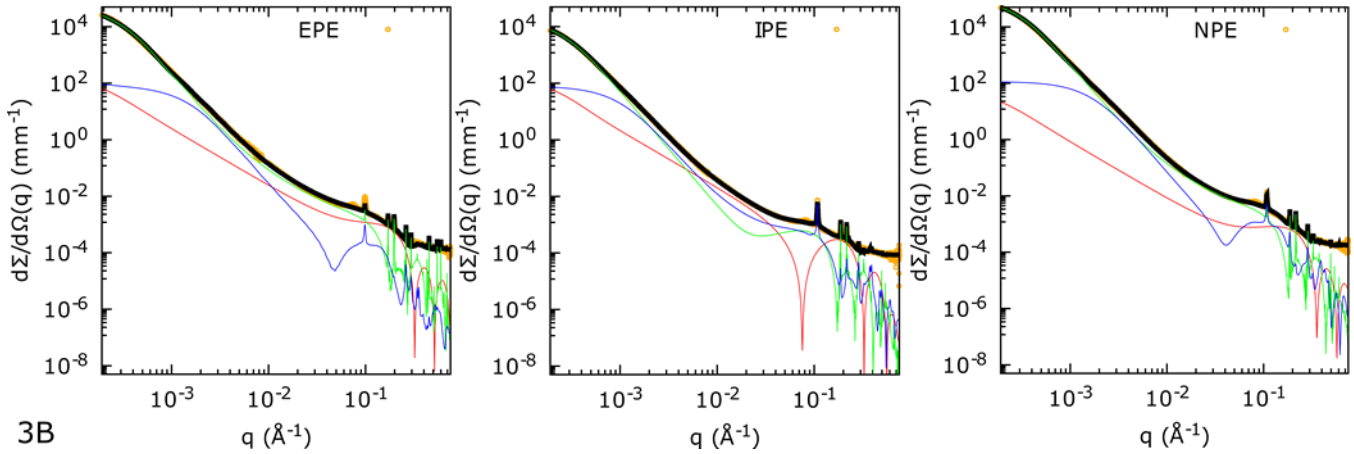


Fig.1


EPE
IPE
NPE
dΣ/dΩ(q) (mm-1)
q (Å-1)
10^4
10^2
10^0
10^-2
10^-4
10^-6
10^-8
10^-3
10^-2
10^-1

3B

Fig.2