Custom-made thermo-sensitive hydrogels as vehicles to locally deliver ibuprofen-loaded mesoporous carbons for a sustained and prolonged payload release.

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CUSTOM-MADE THERMO-SENSITIVE HYDROGELS AS VEHICLES TO LOCALLY DELIVER IBUPROFEN-LOADED MESOPOROUS CARBONS FOR A SUSTAINED AND PROLONGED PAYLOAD RELEASE.

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Ordered mesoporous carbons (OMCs) have been proven to be excellent drug carriers, thanks to their high loading capacity, good cytocompatibility and easy surface functionalization. However, OMCs need to be appropriately incorporated in dosage forms to allow their retention in target tissues for the requested time to completely release their cargo. To overcome this drawback, we embedded ibuprofen (IBU)-loaded spherical and rod-shape OMCs (approx. 120 and 500 nm, respectively, 100% IBU loading) into thermo-sensitive hydrogels (15-20% w/v, up to 10 mg/ml OMC concentration) based on a custom-made amphiphilic poly(ether urethane) (PEU) containing Poloxamer®407 blocks (Mn 72kDa)[1]. OMC incorporation did not worsen the overall gelation potential of PEU aqueous solutions, which still exhibited fast sol-to-gel transition under physiological conditions (few minutes). Rheological characterization highlighted that OMC geometrical features and surface coating with sodium dodecyl sulfate (SDS, 1% w/v to improve OMC dispersibility in aqueous media) played a key role in influencing the progressive organization of the polymeric chains into a gel network. Indeed, spherical OMCs better integrated into the gel network, whereas SDS heads took part to the gelation process through the formation of hydrogen bonds with PEU chains. The developed hybrid formulations released IBU at a slower rate compared to gels loaded with IBU as such (85% vs. 100% IBU released within 3 weeks), thus effectively working as injectable depots progressively releasing their cargo in loco and improving OMC residence-time in the target tissue. Hence, the engineered platform could effectively solve issues related to multiple dosing providing a long-lasting therapeutic device.

References

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