Electronic Supplementary Material (ESI) for Nanoscale Horizons.

Supporting information

Reducing End Modification on Cellulose Nanocrystals: Strategy, Characterization, Application and Challenge

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A Table S1 covering the review articles on the topic of cellulose nanocrystals during last three years is included in this file.

Table S1. Overview of the review articles on the topic of cellulose nanocrystals during last three years. (The related articles are concerning with the surface modification of CNC: ref. 6, 11, 16, 18, 23, 28, 29.)

Year	Title	Focus and brief description	Ref.
2019	Assembly, gelation, and helicoidal consolidation of nanocellulose dispersions	Important analysis of structural evolution of high concentration CNCs dispersion from the recent researches involving in situ, time-resolved small-angle X-ray scattering (SAXS).	1
	A review on cellulose nanocrystals as promising biocompounds for the synthesis of nanocomposite hydrogels	Recent progress in CNC-based hydrogels and its advanced applications covering wastewater treatment, biomedical, biosensing.	2
	Nanocellulose processing properties and potential applications	Concerns to the preparation of nanocellulose from different cellulosic materials and its potential industrial applications and market prospects.	3
	3D bioprinted nanocellulose-based hydrogels for tissue engineering applications: a brief review	Recent developments and challenges in 3D bioprinting nanocellulose-based hydrogel materials with particular emphasis on tissue engineering applications.	4
	Cellulose nanocrystals and cellulose nanofibrils based hydrogels for biomedical applications	Particular emphasis on fabrication of nanocellulose-based hydrogels via new methods and their biomedical applications involving wound dressings, tissue engineering scaffolds and drug delivery in last five years.	5
	A critical review of cellulose-based nanomaterials for water purification in industrial processes	A summary of most recent surface modification methods employed for nanocellulose and the applications of nanocellulose-based materials for removing heavy metals, pharmaceutical and organic compounds.	6
	Nanocelluloses: natural-based materials for fiber-reinforced cement composites. a critical review	Particular emphasis on the use of nanocellulose as reinforcing filler in cementitious composites.	7
	Importance of agricultural and industrial waste in the field of nanocellulose and recent industrial developments of wood based nanocellulose: a review	Particular emphasis on the properties of nanocellulose prepared from agriculture and industrial waste via various processing methods and its potential applications.	8
	Advanced materials through assembly of nanocelluloses	Concerns to the most advanced nanocellulose-based materials including functional fibers, porous aerogels, foams and bulk matter prepared by functionalizing their surface with (bio)polymers, inorganics, or nanocarbons.	9
2018	Cellulose-based biomimetics and their applications	Concerns to the special cellulose-based materials prepared by the inspiration from the petals of the plants, helical filaments produced by plants, colored materials, water-responsive materials in plants, and environmental stimuli-responsive tissues found in insects and plants.	10
	Surface functionalized nanocellulose as a veritable inclusionary material in contemporary bioinspired applications: A review	A summary in various types of surface modification of nanocellulose and its impact to the properties of nanocellulose and nanocellulose-based materials, and concerns to the importance of nanocellulose insome emerging applications, such as biosensor, papermaking etc.	11
	The self-assembly of cellulose nanocrystals: hierarchical design of visual appearance	The analysis of the mechanism in forming iridescent, vivid color materials from liquid crystals suspensions of cellulose nanocrystals, and their complex optical materials assembled by structural control.	12

	Cellulose and nanocellulose-based flexible-hybrid printed electronics and conductive composites–a review	The recent progress in development of nanocellulose-based materials for flexible-hybrid printed electronics.	13
	Cellulose nanocrystals as carriers in medicine and their toxicities: a review	The application of CNCs as drug delivery systems, and the concerns to their safe use, patents and available products.	14
	3D printing with cellulose materials	A discussion about recent development in nanocellulose-based materials for 3D printing covering printing technologies, properties and performance in the fields of smart textile, medical, and electronics.	15
	Advances in cellulose nanomaterials	Recent process made in the production and various surface modification procedures of nanocellulose and the its life cycle assessment studies.	16
	Sugarcane bagasse fiber and its cellulose nanocrystals for polymer reinforcement and heavy metal adsorbent: a review	Particular emphasis on the nanocellulose extracted from sugarcane bagasse and its reinforcing ability to various polymer matrixes.	17
	Nanocellulose, a versatile green platform: from biosources to materials and their applications	A comprehensive analysis of the nanocellulose-based materials from different sources, synthesis methods, surface modification, to various applications.	18
	Current characterization methods for cellulose nanomaterials	Covering the detailed practices, methods and techniques for characterizing nanocellulose-based materials.	19
	Nanocellulose: a promising nanomaterial for advanced electrochemical energy storage	The use of nanocellulose-derived materials as various energy storage systems including supercapacitors, batteries and the integration of nanocellulose with other active materials for developing a number of advanced materials.	20
	Nanocellulose nanocomposite hydrogels: technological and environmental issues	The recent process in synthesis methods and technological applications of nanocellulose-based nanocomposite hydrogels and their applications in agriculture, food, and agriculture biomedicine.	21
	Cellulose nanocrystal (CNC)–inorganic hybrid systems: synthesis, properties and applications	An overview on the recent progress in the development of CNC-inorganic hybirds with additional surface functionalization and their applications as biomedicine and catalyzer.	22
	Grafting Polymers from Cellulose Nanocrystals: Synthesis, Properties, and Applications	Various polymer grafting from approaches employed on surface of CNCs and some emerging applications of CNCs	23
	Nanocellulose as a natural source for ground breaking applications in materials science: Today's state	Current state concerning to the production, structural details, physicochemical properties, and innovative applications of nanocellulose.	24
	Moisture and oxygen barrier properties of cellulose nanomaterial based films	The analysis for the performance of various nanocellulose-based films, papers and nanocellulose coated polymers materials as barrier materials against moisture and oxygen permeation.	25
	Cellulose-based supercapacitors: material and performance considerations	The evaluation and comparison of nanocellulose-based materials energy storage performance using device-specific factors such as volumetric properties, electrode structures, areal capacities, and mass loadings, in particular.	26
2017			
	Nanocellulose in sensing and biosensing	The use of biosensing nanocellulose-based materials in collecting analytical information for various fields including medical diagnosis, food safety, labeling and bioimaging applications etc.	27
	Review of hydrogels and aerogels containing	Particular concerns to the physical and chemical cross-linking methods, post-	28

nanocellulose	modification, and structural control of nanocellulose-based hydrogels and aerogels.	
Recent advances in the application of cellulose nanocrystals	An introduction of surface modification of CNC and the applications and significant impact of CNCs to three fields of energy and electronics, biomedical, wastewater treatment.	29
Nanocellulose in bio-based food packaging applications	A summary of the finding and potential applications of nanocellulose as bio-based materials for food packing.	30
Recent progress in cellulose nanocrystals: sources and production	The recent progress in the production of cellulose nanocrystals with concerns to various cellulose resources, main methods used for its isolation and structural organization.	31
Nanocellulose-based adsorption materials	The recent progress in use of nanocellulose as absorbent materials to remove heavy metal ions, CO_2 gas, dyes and other pollutants.	32
Recent developments on nanocellulose reinforced polymer nanocomposites: a review	Concerns to nanocellulose-based composites covering various processing techniques, different rubber and thermoset polymer matrixs and new findings and cutting-edge studies on electrospun composites.	33
Nanocellulose-based foams and aerogels: processing, properties, and applications	The main processing methods and properties of nanocellulose-based aerogels, and foams with particular emphasis on the preparing methods of ice templating.	34
Nanocellulose-based conductive materials and their emerging applications in energy devices – a review	Recent progress in the development of preparing nanocellulose-based conductive materials and the energy devices involving solar cells, lithium ion batteries and supercapacitors.	35

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