

Review

Nanocellulose, the Green Biopolymer Trending in Pharmaceuticals: A Patent Review

Keth Ribeiro Garcia ¹, Ruy Carlos Ruver Beck ¹, Rosmary Nichele Brandalise ², Venina dos Santos ² and Letícia Scherer Koester ^{1,*}

¹ Programa de Pós-Graduação em Ciências Farmacêuticas, Faculdade de Farmácia, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre 90610-000, Brazil; k1rgarcia@gmail.com (K.R.G.); ruy.beck@ufrgs.br (R.C.R.B.)

² Programa de Pós-Graduação em Engenharia de Processos e Tecnologias, Universidade de Caxias do Sul (UCS), Caxias do Sul 95070-560, Brazil; rnbranda@ucs.br (R.N.B.); vsantos2@ucs.br (V.d.S.)

* Correspondence: leticia.koester@ufrgs.br; Tel.: +55-51-33085278

Supplementary material

Table S1. Patents separated by clusters after examination of documents obtained in WIPO, Espacenet, and Lens.org databases, comprising the timeframe between 2011 – Aug., 2023, with the search terms “nanofibrillar cellulose”, “nanofibrillated cellulose”, “cellulose nanofibers”, “microfibrillated cellulose”, “cellulose nanocrystals”, “nanocrystalline cellulose”, “nanocellulose”, “pharmaceutical”, “excipient”, and “drug delivery” combined with Boolean operator and truncation symbol.

<i>Cluster</i>	<i>Patent number</i>		
Design & Manufacturing	US 2018/0094081 A1	US 2020/0032454 A1	US 2023/0220118 A1
• Manufacture	US 10626191 B2	EP 3382095 A1	US 11572418 B2
	WO 2016/177395 A1	WO 2018/177878 A1	EP 3947533 B1
	US 10626191 B2	US 2019/0298838 A1	US 2023/0151545 A1
	WO 2019/238327 A1	WO 2016/109479 A1	US 11649296 B2
	US 2021/0130500 A1	US 2016/0184438 A1	US 11649333 B2
	EP 3581591 A1	EP 3212676 B1	EP 3533458 B1
	US 2021/0077403 A1	WO 2020/075057 A1	US 11602566 B2
	EP 3791864 A1	US 2019/0040581 A1	US 11634549 B2
	WO 2016/102767 A1	US 10883226 B2	US 11572450 B2
	US 2018/0179703 A1	WO 2017/134334 A1	US 11549085 B2
	US 10822743 B2	EP 3574143 B1	US 2022/0387955 A1
	WO 2016/193548 A1	US 2020/0023409 A1	WO 2022/249052 A1
	WO 2017/174874 A1	WO 2018/138702 A1	EP 4094827 A1
	EP 3228329 A1	WO 2020/058803 A1	US 2022/0389121 A1
	US 2019/0111175 A1	WO 2020/075056 A1	US 11440974 B2
	WO 2016/128620 A1	WO 2019/123405 A1	US 2022/0389261 A1
	US 2018/0021473 A1	WO 2019/073370 A1	US 11511015 B2
	US 10729804 B2	US 2021/0207324 A1	US 2022/0349651 A1
	US 2021/0205490 A1	US 2019/0234020 A1	EP 4083112 A1
	WO 2017/115018 A1	US 10927504 B2	US 2022/0275583 A1
	EP 3187195 A1	WO 2017/221137 A1	US 2022/0249378 A1
	EP 3187195 B1	EP 3475485 B1	US 2022/0233412 A1
	EP 3077592 B1	WO 2010/092239 A1	US 2022/0213298 A1
	WO 2015/082774 A1	US 9181653 B2	US 2022/0186049 A1
	EP 3077592 B2	US 2014/0182797 A1	US 2022/0185976 A1
	US 10214855 B2	US 2020/0086604 A1	US 2022/0177661 A1
	US 2016/0289894 A1	WO 2018/189698 A1	US 2022/0177660 A1
	US 2017/0190799 A1	WO 2019/171279 A1	EP 3228329 B1
	US 10113006 B2	WO 2020/102605 A1	WO 2022/097095 A1
	WO 2015/197906 A1	WO 2011/030170 A1	US 11324701 B2
	WO 2016/024046 A1	WO 2021/123499 A1	EP 3970945 A1
	EP 3350368 B1	US 10813377 B2	US 2022/0025147 A1
	US 2017/0218567 A1	CA 3003670 A1	US 2022/0018060 A1
	US 10570564 B2	US 2021/0045422 A1	
	WO 2017/046455 A1	WO 2017/075417 A1	
	RU 2719165 C1	US 2018/0319957 A1	
	WO 2017/103328 A1	CN 108430237 A	
	US 10640632 B2	CA 3003670 C	
	US 2018/0371211 A1	WO 2017/105337 A1	
	CN 103520739 A	US 2018/0291119 A1	
	US 9611586 B2	US 11084885 B2	
	US 2014/0323714 A1	US 2020/0157250 A1	
	EP 2782937 B1	WO 2018/231143 A1	
	US 10570564 B2	WO 2020/227816 A1	
	EP 3581590 A1	WO 2020/201627 A1	
	WO 2013/076376 A1	US 9970159 B2	
	US 10113005 B2	US 2018/0044856 A1	
	EP 2935446 B1	WO 2018/013034 A1	
	US 2015/0322170 A1	WO 2021/229406 A1	
	WO 2014/096547 A1	US 11174324 B2	

• Process	US 10625232 B2	US 2021/0127663 A1	WO 2019/116245 A1
	WO 2016/102766 A1	WO 2018/108341 A1	WO 2012/152997 A1
	US 2017/0348662 A1	EP 3335696 B1	US 2014/0130710 A1
	EP 3237108 B1	EP 3335696 A1	EP 4201963 A1
	US 2021/0229057 A1	WO 2018/109282 A1	WO 2023/084383 A1
	US 2017/0348663 A1	US 2019/0343889 A1	EP 3331939 B1
	WO 2016/102764 A1	WO 2010/102802 A1	US 11555186 B2
	US 10981135 B2	US 10017583 B2	EP 4083113 A1
	EP 3237107 B1	US 2016/0130368 A1	US 2022/0325003 A1
	US 2020/0078305 A1	WO 2014/195971 A1	US 11421118 B2
	WO 2018/109281 A1	EP 2812483 B2	WO 2022/006644 A1
	WO 2016/102765 A1	US 2014/0374045 A1	
	US 2017/0368211 A1	EP 2812483 B1	
	US 10322196 B2	US 2016/0186376 A1	
	EP 3237025 B1	US 9315942 B2	
	EP 3335695 A1	WO 2013/117823 A1	
	EP 3335695 B1	US 9725849 B2	
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Cell culture systems and cell technology	US 2020/0385660 A1	US 2020/0164103 A1	WO 2023/012333 A2
	EP 3750982 A1	WO 2016/100856 A1	EP 4119657 A1
	US 2021/0214510 A1	EP 3233493 B1	EP 4082587 A1
	EP 3572434 A1	US 2020/0206385 A1	EP 3684433 B1
	EP 3669651 A1	US 2017/0368225 A1	WO 2022/207889 A1
	US 2020/0199536 A1	US 10675379 B2	WO 2022/144489 A1
	WO 2020/260741 A1	EP 3418377 A1	EP 4023744 A1
	WO 2021/127373 A1	WO 2018/234634 A1	US 2022/0213432 A1
	EP 3234600 B1	US 2020/0115678 A1	US 2022/0214329 A1
	US 2021/0190765 A1	CA 3140249 A1	EP 3967748 A1
	US 10976308 B2	US 11186736 B2	US 11332714 B2
	WO 2016/097490 A1	US 2021/0179871 A1	AU 2020/312637 A1
	US 2018/0024121 A1	EP 2975115 A1	AU 2020/313511 A1
	EP 2900806 B1	EP 3669651 B1	CN 114127279 A
	WO 2014/049204 A1	WO 2023/113685 A1	CN 114080242 A
	EP 3699264 A1	EP 3699264 B1	MX 2021015757 A
	US 2015/0267164 A1	US 2023/0082321 A1	MX 2021015722 A
	US 9593304 B2	EP 4148071 A1	
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Drug delivery			
• Injectable	CA 3101156 A1	WO 2012/056111 A2	
	US 2021/0085602 A1	EP 2632493 B1	
	JP 2021046393 A	US 2013/0330379 A1	
	EP 3791858 A1	US 9631177 B2	
		US 2022/0257753 A1	
• Oral	WO 2021/071974 A1	WO 2021/116917 A1	
	CN 112336741 A	WO 2018/009139 A1	
	US 2021/0030782 A1	WO 2013/009253 A1	
	WO 2019/094769 A1	CN 115400101 A	
		CN 114732801 A	
• Buccal	WO 2018/104971 A1		
	WO 2018/152627 A1		
	US 2020/0281868 A1		
	US 11478435 B2		
• Topical	WO 2020/031186 A1	WO 2018/009113 A1	
	US 9816230 B2	US 2020/0188538 A1	
	US 2016/0186377 A1	WO 2017/117650 A1	
	WO 2018/009112 A1	WO 2020/227814 A1	
• Transdermal	WO 2021/108722 A1		
	US 2020/0375878 A1		
	EP 3730122 A2		

• Matrix	WO 2013/072563 A1	
	US 2014/0322327 A1	
	US 2021/0015121 A1	
	WO 2019/108887 A1	
	US 2020/0254046 A1	
	WO 2018/015175 A9	
	WO 2018/015175 A1	
	WO 2023/009976 A1	
	US 2023/0028624 A1	
	US 2023/0017712 A1	
	US 11389537 B2	
Wound healing	EP 3771470 A1	US 2013/0330417 A1
	US 2021/0030919 A1	WO 2017/103263 A1
	WO 2019/166606 A1	EP 3181152 A1
	EP 3533458 A1	US 2016/0325011 A1
	US 2021/0170041 A1	EP 3088008 A1
	EP 3816338 A1	EP 3402462 B1
	US 2021/0128365 A1	WO 2017/122224 A1
	WO 2018/109275 A1	US 2019/0015468 A1
	EP 3335740 A1	US 10426809 B2
	US 2019/0336643 A1	WO 2018/130390 A1
	US 2014/0213764 A1	US 11173228 B2
		WO 2023/118589 A1
		US 2023/0181791 A1
		US 11534526 B2
Tissue engineering	WO 2020/249814 A1	US 2023/0226098 A1
	US 2021/0069964 A1	WO 2023/133517 A1
	US 2021/0138113 A1	WO 2023/118966 A1
	WO 2019/211854 A1	US 11602579 B2
	WO 2020/249814 A1	US 2022/0249738 A1
	WO 2019/122351 A1	US 2022/0145259 A1
	US 2019/0015550 A1	WO 2022/003203 A1
	US 11103617 B1	EP 3932437 A1
	US 11167062 B2	
	US 11713444 B2	

Table S2. Patents separated by clusters after examination of documents obtained in WIPO, Espacenet, and Lens.org databases, comprising the timeframe between 2011 - Aug., 2023, with the search terms “bacterial nanocellulose”, “pharmaceutical”, “excipient”, and “drug delivery” combined with Boolean operator and truncation symbol.

<i>Cluster</i>	<i>Patent number</i>	
Design & Manufacturing	WO 2020/136629 A1	US 2019/0060205 A1
• Manufacture	US 10975242 B2	WO 2012/106707 A3
	US 10982387 B2	US 2013/0309295 A1
	JP 2021065224 A	WO 2012/106707 A2
	CN 109223727 A	KR 20200085090 A
	WO 2021/009021 A1	US 2021/0015966 A1
	WO 2021/009038 A1	WO 2023/108017 A2
		WO 2023/070028 A1
		WO 2023/048674 A1
		WO 2022/200631 A1
• Process	US 10870950 B2	
	WO 2017/165465 A1	
	US 2021/0071366 A1	
	US 2019/0093288 A1	
	WO 2023/089010 A1	
Drug delivery		
• Intraocular	US 2013/0011385 A1	
	US 8940337 B2	
	WO 2011/079380 A1	
• Oral	CN 103191441 A	
	CN 102743356 A	
• Topical	CN 210673549 U	US 2018/0303726 A1
	US 2011/0039744 A1	US 2020/0364264 A1
	WO 2011/019876 A2	EP 3812494 A1
	US 8097574 B2	US 2021/0140100 A1
	US 10736823 B2	US 2011/0286948 A1
	EP 3380072 B1	US 8772003 B2
	WO 2017/089005 A1	
• Transdermal	CN 106074458 A	
• Matrix	US 2012/0308649 A1	
	US 8871743 B2	
	WO 2020/058836 A1	
Wound healing	CN 111265709 A	US 9314531 B2
	US 9211256 B2	US 2012/0231038 A1
	US 2016/0074520 A1	
Tissue engineering	US 2018/0298370 A1	CN 105031722 A
	WO 2016/174104 A1	US 2016/0354406 A1
	RO 130767 A0	US 10130653 B2
	US 10767205 B2	WO 2021/245324 A1