Science update

Since the fellowship started in 2021, Drs Anita Etale and Amaka Onyianta have been working on developing their research to produce functional cellulosic materials for composites and other applications. This has resulted in a number of high impact papers, and we've made them all Open Access which means anyone can download and read them, but we hope these summaries are helpful to readers of our website.

One of the first publications was an international review in *Journal of Materials Science* (IF* = 4.682), where Anita contributed her work on using cellulosic materials for water filtration. This review is already highly cited, and can be found here https://link.springer.com/article/10.1007/s10853-022-06903-8.

Both Amaka and Anita developed some earlier work we had been doing in the lab to make modified cellulosic materials stick to polypropylene pellets, but moreover make them then dispersible in water. We found strong associations with octylamine and hexadecyl modified cellulose nanocrystals which resulted in a way of aqueously processing the materials – a real breakthrough in our ability to process cellulose in a way that does not destroy their hydrophilicity, which is often suppressed for natural fibre composites. The paper, published in *ACS Applied Polymer Materials* (IF = 4.855), is to be found here, along with Amaka's lovely infographic (see Figure 1) that she made to explain the concepts (https://pubs.acs.org/doi/10.1021/acsapm.2c01623).

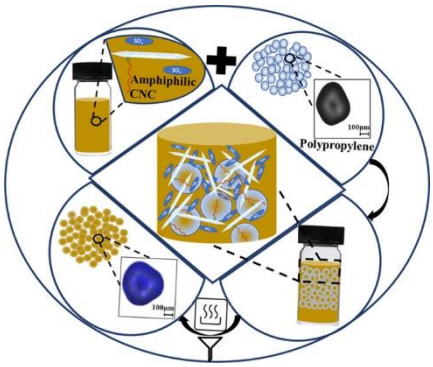


Figure 1: Infographic explaining work to disperse polypropylene pellets in water. Reproduced from https://pubs.acs.org/doi/10.1021/acsapm.2c01623 (CC-BY).

Both Anita and Amaka got involved in assisting a PhD student in the lab – Muhammad Ichwan (now graduated with his PhD!) – in characterizing his cellulose nanocrystals from oil palm. His paper, published in a new journal *Carbohydrate Polymer Technologies and Applications* (is to be found here (https://www.sciencedirect.com/science/article/pii/S2666893922000871?via%3Dihub).

Anita got some experience too of supervising an MSc student (Matthew Leeder) who developed filtration media based on cigarette filters that are reprocessed using a technique called electrospinning. This technique, for polymer fibres, was first developed by the Jamaican/Canadian scientist Dr Rockcliffe Manley (see our blog https://engineering.blogs.bristol.ac.uk/forgotten-histories-of-black-engineers-and-scientists/ and https://en.wikipedia.org/wiki/Rockcliffe_St._J._Manley). The filters were found to have very high oil sorption properties, probably due to the presence of glycerol triacetate in the cigarette filters, as well as the cellulose acetate. This paper, published in *Materials Letters* (IF = 3.574), can be found here (https://www.sciencedirect.com/science/article/pii/S0167577X23001507?via%3Dihub).

Amaka has made a major contribution to a real industrial problem associated with nanofibrillated cellulose (or cellulose nanofibrils CNFs), in that it is really hard to redisperse this material from the

dried state. Currently these materials are transported wet, which adds cost. Amaka came up with a really simple but effective way to tackle this using a liquid phase exchange with isopropyl alcohol (https://www.sciencedirect.com/science/article/pii/S0144861723004083?via%3Dihub). The paper was published in one of the premier journals in our field, *Carbohydrate Polymers* (IF = 10.723). This has real potential to provide a cheap and effective way to tackle this problem.

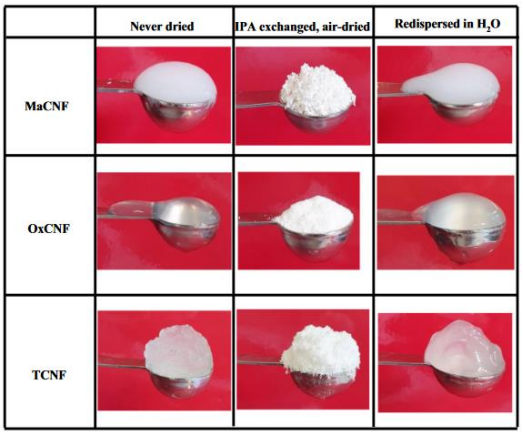
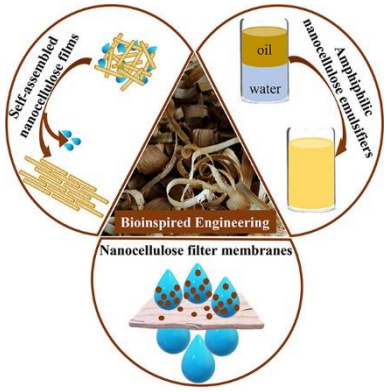


Figure 2: Redispersion of cellulose nanofibrils (CNFs) showing never dried materials, isopropyl alcohol exchanged materials that have been air dried, and then those materials redispersed in water. Maine cellulose nanofibrils (MaCNF), Oxalic acid modified cellulose nanofibrils (OxCNF), TEMPO oxidised cellulose nanofibrils (TCNF). Reproduced from https://www.sciencedirect.com/science/article/pii/S0144861723004083?via%3Dihub (CC-BY).

Amaka also contributed to the paper by one of our PhD students – Jing Wang (now graduated). This was published in *Advanced Materials* (IF = 32.086) on battery separators. Amaka's cellulose nanocrystals derived from seaweed were used for this work.

Finally, last but not least Anita and Amaka worked hard on co-writing a review in the premier journal *Chemical Reviews* on water interactions with cellulose (https://pubs.acs.org/doi/10.1021/acs.chemrev.2c00477). Just to put this into context, there have only been 26 papers in this journal from the University of Bristol, and that starting from 1936! The journal has an IF of 72.087, so quite some impact and prestige to have a paper accepted there. This paper was published in a special issue of the journal (see Figure 3 for the infographic – see the similarity in style to Figure 1, and the paper copy).



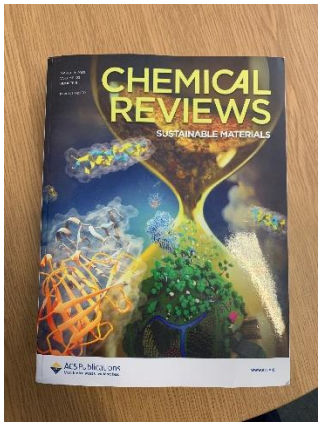


Figure 3 The graphic for the paper in Chemical Reviews (https://pubs.acs.org/doi/10.1021/acs.chemrev.2c00477) (CC-BY) and the paper copy of the special issue of the journal

Before joining the group at Bristol both Anita and Amaka had ongoing research that they published during their time with us. It's really quite a phenomenal output that they generated. Links to these papers can be found here:

https://www.tandfonline.com/doi/full/10.1080/1573062X.2022.2155847

https://www.sciencedirect.com/science/article/pii/S2352492822018694?via%3Dihub

https://onlinelibrary.wiley.com/doi/10.1002/hfm.20977

https://www.mdpi.com/2227-9717/10/6/1150

https://www.tandfonline.com/doi/full/10.1080/1573062X.2022.2026984

https://www.sciencedirect.com/science/article/pii/S2214785322006733?via%3Dihub

https://www.sciencedirect.com/science/article/pii/S2214785322006629?via%3Dihub

https://www.worldscientific.com/doi/10.1142/S2010135X22420085

New postdocs have now joined the group as Amaka and Anita both went into industry (more about that in another post) but I am sure that they – Drs Alessandra Lavoratti and Onajite Abafe Diejomaoh – will be doing great work too!

* IF = Impact Factor. This is a scientometric index that is calculated on the mean yearly number of citations a journal receives over a 2 year period. Some people dispute its use, and it should not be used as a quick indication of the worth of someone's science, nor the person themselves. However, generally higher citations can give an indication of the impact of a paper's worth. We aim to publish in a range of journals with differing impact factors, but most of all make a paper accessible to as wide an audience as possible.