Creating nanotech innovation

Dr Akindeju plans to transform the region's manufacturing

BY **MALVIKA HEMANTH**

SCIENCE is ever evolving and one professional is determined to ensure the region is at the forefront of innovation as he plans to make Ballarat a bustling hub for nanoparticle production.

Dr Michael Akindeju is the director and principal consulting process chemical engineer at Lucas-based engineering firm MKPro Group.

He said the creation of nanoparticles, which are widely used in a range of applications including cosmetics, medicine and renewable energy, was in a dire state here in Australia.

Currently, the country is dependent on other nations, namely China, for the valuable resource however Dr Akindeju has ambitions to change that and has already put his expertise into action launching the pilot phase of his nanotechnology plant in August of this year.

"In Australia there aren't any commercial nanoparticle producers and the problem we have with importing is the variability in size of these nanoparticles," Dr Akindeju said.

"For example the authentication certificate a company might issue a client says the particles are 20 nanometre but when the client analyses it they find the particles are in the order of 500 nanometres, some even five nanometres.

"This is a huge problem and even more so in industrial applications."

He said his factory despite only being in operation for a few months is able to address such deficits in Australia's manufacturing processes.

"What we have done, controlling for the morphology, the particle size and distribution, is we are making it a lot easier for industrial application and to readily use the product (nanoparticles)," Dr Akindeju said.

"This is because we produce to an Australian standard so we can confirm the product we are producing is what it has been labelled as."

While Dr Akindeju is unable to disclose who his nanoparticles are sourced to at this time, he was able to mention where his nanoparticles were being used including in cancer treatment drugs.

He said the method of implementing nanoparticles in the field of therapeutic medicine was an "attractive" alternative as opposed to other methods available such as intravenous dispensation.

"Currently, the general concept is you have the cancer tablet that is sugar coated and then the patient consumes it but because of the way sugar is, as soon as it enters the body, it dissolves," Dr Akindeju said.

"That means there's a dispersion of the medicine and that is systemic so the amount that will go to the target site maybe limited so what is being done now in the medical field is to deliver those drugs either through injection or other means but an attractive method is when you actually use nanoparticles as carriers of the drugs."

He said it is the surface area of nanoparticles which makes them most effective.

"Once we identify what element will react with say the lungs or the liver or the heart, we then produce those nanoparticles of that element in a nanoscale," Dr Akindeju said.

"The cancer medicine is put into the pores of the nanoparticle to carry the drug to the specific site and because certain chemicals only react to certain organs in the body whatever element the nanoparticles are made of will ensure the medicine will only react with that particular organ.

"When you look at them (nanoparticles) under a microscope you actually find their pores are like ridges so they can hold medicine in them. "So when a patient ingests them they go straight to where it is they are needed, the nanoparticles react with the surface of the organ and that is where they then get released."

MKPro Group chemical engineer Dr Michael Akindeju created his own nanotechnology plant in August. Picture by Adam Trafford.

He said the time it takes to manufacture these nanoparticles is also another enticing factor for their practicality in modern day life.

"For example for the iron cobalt complex nanoparticles we are producing for cancer therapeutics we start by modelling at the molecular level, we then extract the parameters that are required to then be used in the plant and then once we have done that we prepare the reagents," Dr Akindeju said.

"Once we produce them we then have them in a holding tank and then we dry them. Once they are dried they are ready for use.

"So from the point we start pumping to the final output it is about a second and in that second we'll produce about five grams of nanoparticles."

Another main instigator which propelled Dr Akindeju to establish his plant was the need to create more employment options for specialists like himself.

"When I came to Ballarat in 2013 opportunities for chemical engineers were very limited and of course I have the knowledge so I asked myself what can I do in Ballarat that would be commercially viable and would be relevant in our time," he said. It is this pioneering thinking which has led to Dr Akindeju to set his ambitions high as he envisions to make Ballarat a "regional hub for nanoparticle synthesis".

"The objective is to solve problems in Ballarat and by 2025 I want to have at a minimum employing eight people working in the plant and hopefully as commercial demand improves we can employ more people," he said.

"Hopefully by this time next year we will be at the back of testing and validating all the data for the project."