The Future of Nanotechnology in Malaysia

NANOTECHNOLOGY is the understanding and control of matter at nanoscale dimensions between 1-100 nanometers, forming structures and systems with unique physical, chemical and biological properties that enable novel applications.

According to the Malaysia Nanotechnology Association, nanotechnology can lead to a wealth of innovative new technologies across a vast array of fields including agriculture, healthcare, information technology, energy production and utilisation, homeland security and national defense, biotechnology, food and agriculture, aerospace, materials manufacturing and environmental improvement.

With so much potential, it is understandable why it has been identified as the country's growth engine. And the most suitable person to lead this growth is none other than Prof. Dr Halimaton binti Hamdan, who spent some time with JURUTERA to talk about the development of nanotechnology in Malaysia.

Malaysia's involvement in nanotechnology started back in 2003, when the country became a member of the Asia Pacific Nanotechnology Forum which was initiated by Japan. Since then, members of the forum have gathered to discuss the latest nanotechnology development every year.

Two years later, then Deputy Prime Minister Datuk Seri Mohd. Najib bin Tun Abdul Razak gave Prof. Dr Halimaton the green light to set up a formal establishment for nanotechnology in Malaysia. This was swiftly followed by a proposal of the National Nanotechnology Initiatives, which was approved by the Cabinet in 2006.

In 2009, Prime Minister Datuk Seri Mohd. Najib identified nanotechnology as an important growth engine for the new economic policy that will stimulate and accelerate development of home grown nano science, engineering and technology into beneficial technologies.

Prof. Dr Halimaton explained, 'Nanotechnology is an enabling technology because the basics of nanotechnology is fundamental science, chemistry and even physics. In other words, it is a fusion of these knowledge and is not confined to a single technology.'

She added, 'Being a small country, Malaysia does not have the critical mass. As such, we have to focus on specific areas as far as R&D is concerned and translate the output into commercial applications. Having decided to focus on the health, energy and environment sector, we hope to come up with alternative renewable energy and new ways to improve our health and the environment.'

To achieve this, Prof. Dr Halimaton has recently been seconded to the Ministry of Science, Technology, and Innovation (MOSTI) to serve as Under Secretary of the National Nanotechnology Directorate. The latter is responsible for coordinating, organising and consolidating national R&D activities, facilities and support services.

One of the roles of the directorate is to identify centres that have strengths in different areas of research. Prof. Dr Halimaton hopes to form a consortium and bring researchers together for them to collaborate and share resources as some areas of nanotechnology require a huge capital investment in new equipment.

She said, 'We have a strong group working on nanotechnology. Hopefully, in two years, we will be able to form a central organisation as well as a central laboratory for all nanotech players. Before that can happen, we need to come up with a nanotechnology policy, roadmap, strategy planning as well as the direction of where we are heading in the next few years.'

Currently, some researchers are working on nanomaterials and processes, while others are working on the technology itself, *i.e.* nanoelectronic devices and systems. A local university is doing research on medical related nanotechnology.

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There are also research groups working on nanoparticles and advanced nanomaterials. Nanoparticles, regardless whether it is organic or inorganic, are very useful as construction material and for the pharmaceutical and cosmetics industry. Some researchers are working on nanocatalyst for industrial processes in the petrochemical and food industry.

In the environmental sector, there are research groups working on membranes and filters for the purpose of water and air treatment. According to Prof. Dr Halimaton, some of these researches are already in the post laboratory phase while others are in the process of being commercialised.

For example, nanocatalyst development by researchers from Universiti Malaya and Universiti Teknologi Malaysia are now being prepared for commercialisation. Another product that is being commercialised is her

very own invention which she calls the Myaerogel. It is a silica based compound made from rice husk which can be used as an insulation material against heat and sound in ceilings and walls insulation

According to Prof. Dr Halimaton, the increasing awareness of the younger generation in nanotechnology development is a result of Hollywood blockbusters such as GI Joe. In the movie, nanomites or nanites, which are extremely microscopic robots, were used by the opposing forces for military purposes. However, very soon, this technology will no longer be restricted to science fiction movies. A similar technology known as nanobots, which come in the form of DNA molecules, is currently being developed.

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One of the advantages of nano material is that only a small amount is needed. For example, just one teaspoon of Myaerogel can cover the surface area of a football field. She said, 'The public perception has this perception that nanomaterials or nanoparticles are a threat to health because it can be easily inhaled when it becomes airborne. However, this fear is unfounded because, most nanomaterials or nanoparticles are embedded or incorporated into other materials.'

For example, nanoparticles are imbedded within the grains of clothing material to form nanoclothing. The presence of nanoparticles in a jacket, for instance, makes the latter self cleaning. Japanese astronauts who wear clothing made from nanomaterials have no need to wash their clothes for up to 6 months.

Besides clothing, nanomaterials can also be used as building materials. Smart windows, which are incorporated with nanomaterials, can make automatic adjustments when it senses a change in temperature and sunlight. In the health sector, researchers have discovered that nano gold particles can be manipulated to kill cancer cells in the body.

Despite all these benefits, Prof. Dr Halimaton pointed out that a fear of nanotechnology remains deeply entrenched in the minds of the public because movies tend to depict nanotechnology in a bad light. She said, 'Just like nuclear energy, the public tend to focus on the dangers of nanotechnology and ignore its benefits.' That is why public awareness and education via roadshows, demonstrations and lectures are very important.

This year, Nanotech Malaysia 2010 will be held in December at the KL Convention Centre. Besides exhibitions, forums and conferences for different groups of audience, there will also be an education section especially catered to schoolchildren.

The effort to promote nanotechnology does not stop here. Prof. Dr Halimaton has also taken the initiative to visit schools and educate the students about nanotechnology and its benefits. The directorate is also looking into the possibility of incorporating nanotechnology into the school curriculum with the help of the Ministry of Education.

In Malaysia, several local universities currently offer postgraduate research in various areas of nanotechnology. However, undergraduates do not have the same opportunity. According to Prof. Dr Halimaton, the government had planned to introduce the module a few years back, but felt at that time that there may not be enough job opportunities for the graduates as the industries were not yet ready.

She pointed out that the most urgent need at the moment is to encourage more youngsters to take an interest in science subjects. At the tertiary level, this has become a genuine concern as the number of students taking up science subjects is actually decreasing. She would like to see a reversal in this trend as nanotechnology is now offering more opportunities than before. She observed that, throughout this year, six out of 10 new innovations were based on nanotechnology.

This is evident in its development in many consumers products such as cosmetics and electronics. In the construction industry, many advanced materials are currently being studied and tested by the engineers. For example, engineers are currently studying the use of nanotube to create a composite material that could protect against corrosion during the building of bridges.

According to Prof. Dr Halimaton, the country is fortunate because the government is behind the development of nanotechnology. She said, 'For nanotechnology to reach its full potential, we need the collaboration and support from the different sectors and industries.'

Although impressive, Malaysia's achievements in nanotechnology lag behind those of other Asian countries such as South Korea. Although both countries started out at about the same time, Korea is now very much ahead. Prof. Dr Halimaton said, 'Malaysia has to form a strategy to focus on the areas that we are strong in. As such, engineers can play a big role regardless of their area of specialisation.' ■

Biodata on Prof. Dr Halimaton binti Hamdan

Universiti Teknologi Malaysia Professor of Chemistry Prof. Dr Halimaton was conferred the Merdeka Award 2009 for Health, Science and Technology initiated by PETRONAS, and co-founded by ExxonMobil and Shell. She has published widely in leading journals and has more than 20 years of synthesis and development of zeolite and nanostructured materials.

Currently, she is the Executive Director of Enabling Science and Nanotechnology Research Alliance (eSciNano), Universiti Teknologi Malaysia, Physical Chemistry Professor of Chemistry, Faculty of Science, and a fellow as well as the Chairperson of Nanotechnology Taskforce for the Academy Sciences of Malaysia.

She is also a Steering Committee member of the International Cooperation Partner Countries (ICPC) of the European Union for Nanotechnology. Halimaton received a BSc in Chemistry from Indiana Univeristy, MS Chemistry from Marshall University and a PhD in Physical Chemistry from Peterhouse, University of Cambridge.