

globe edition
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A team of local secondary school students create a winning device that can remove copper ions from water, writes **Nicola Chan**

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Improving the system

Back in 2015, the discovery of lead in a public estate's drinking water sparked concerns over the effects of water pollution on people's health. Inspired by the incident, 39 students from five local secondary schools teamed up to create a device that could lower the copper-ion concentration in aquaponics (raising both aquatic animals and cultivating plants in the same water).

A similar project was previously done by a group of seniors in 2016, but the secondary students from the joint school alliance, Hong Kong JSS, wanted to improve upon it. This time around, they used genetically modified *E. coli* - a bacteria commonly found in human and animal intestines - to absorb copper ions in aquaponics. Although copper - which is present in water in the form of ions - is a nutrient for humans, excessive intake can lead to health problems.

In early November, 30 of the members flew to Boston in the United States to present their idea at the International Genetically Engineered Machine Competition, an annual worldwide event that gathers young biology talents across the globe and their innovative solutions to everyday problems.

The team's experimental design and findings made them the first secondary school in Hong Kong to win a gold medal.

Young Post sat down with three of the team members last week to learn more about their project.

"We've taken a lot of water samples from different aquaponic systems, from which we detected a high concentration of copper," says team leader Yoyo Yip Sze-man, 16.

They chose to fix this problem for their project because they already had access to something that could help them detect and measure the amount of copper in water, said the Po Leung Kuk Celine Ho Yam Tong College student.

She adds that they hoped the technology they came up with could be used to remove other heavy metal pollutants found in water.

The students from PLK Celine Ho Yam Tong College, United Christian College (Kowloon East), Yan Oi Tong Tin Ka Ping Secondary School, Pentecostal School, and St Teresa Secondary School split up into school teams led by their respective biology teachers.

Some were in charge of developing, testing and evaluating their hypotheses, while others took to the street to raise awareness of the hazards of water

contaminated with heavy metals, and surveyed different people in the aquaponics industry.

The team discovered that *E. coli* could better absorb copper if they either increase its copper binding proteins, or get rid of the genes that export copper. In light of this discovery, they then developed their bacteria copper absorption device (B-cad) that incorporated the two types of genetically modified bacteria.

We took a lot of water samples from different aquaponic systems, and detected a high concentration of copper

The B-cad has artificial tubes that can take in copper ions, while not letting the *E. coli* out. The resulting device is able to remove 25-55 per cent of the copper in a aquaponic system with 5-15mg/L copper ion in 48 hours.

"After consulting fish owners and potential users of the device, we added a cage around the [tubes] to

prevent them from being bitten off by fish, which could potentially die if the bacteria was leaked to their habitats," says Yoyo.

Oscar Lam Ho-him from Pentecostal School was responsible for collecting views from the stakeholders, analysing the data, and promoting their initiative. Despite talking to several stakeholders, the 16-year-old admitted feeling nervous when presenting his team's ideas at the iGEM competition.

"I was worried that I might not be able to answer the audience's questions. But it worked out," the 16-year-old said.

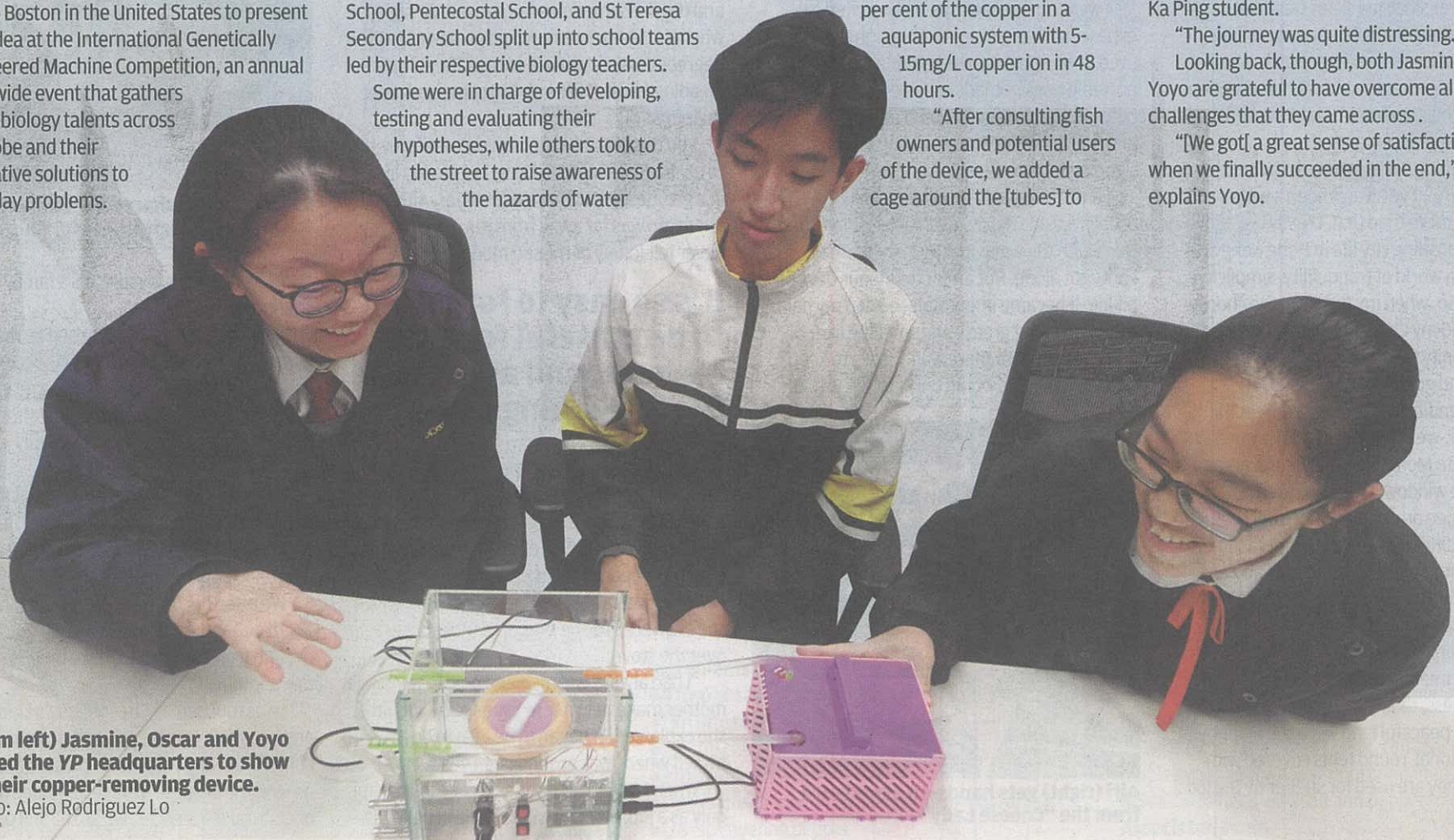
When asked what their most memorable challenge was, Jasmine Yu On-yi, 16, recalls the many times she and her teammates had to stay in school until 8pm.

"Because our experimental results weren't always what we expected, we [had to repeat] the same experiment - which takes about four hours to complete - after school about three to four times in total," said the Yan Oi Tong Tin Ka Ping student.

"The journey was quite distressing."

Looking back, though, both Jasmine and Yoyo are grateful to have overcome all the challenges that they came across.

"[We got] a great sense of satisfaction when we finally succeeded in the end," explains Yoyo.



(From left) Jasmine, Oscar and Yoyo visited the YP headquarters to show us their copper-removing device.

Photo: Alejo Rodriguez Lo