

5th Innovation Multipliers Workshop

Workshop 2 – SMEI Phase II Proposal

Koli-Klere Water Testing



The Company

Koli-Klere was originally a spin-out from one of Turkey's leading technical universities. It is based on the PhD work of two biotechnology students who had the idea that if microscopic holes could be accurately produced they could be used to restrict the flow of bacteria, provided that these holes are made smaller than the bacteria themselves.

The Device

The concept has been successfully incorporated into a device which captures bacteria 100%. Photo-sensors are then used to detect the bacterial presence in order to trigger a warning or record the event. The capturing devices are contained in disposable cartridges which are used to test production flow lines, then retained for later 'off line' analysis. Initial market studies have not identified any similar equipment on the market and Koli-Klere are convinced that they have a novel 'world first' in their product.

The Technology

Semiconductor quantum dots (QDs) have been used in a simple fluorometric assay to detect single cells of the pathogenic *Escherichia coli* O157:H7 serotype. Composed of CdSe/ZnS core/shell QDs conjugated to streptavidin, this system is orders of magnitude more sensitive than a similar assay using a common organic dye. Selectivity for this pathogenic bacterial strain over a common lab strain (*E. coli* DH5 α), which is gained from the use of specific biotinylated antibodies, is also demonstrated for QD labeling. Under continuous excitation, these QDs retain high fluorescence intensities for hours, whereas a typical organic dye bleaches within seconds, allowing for more rapid and accurate identification of *E. coli* O157:H7 in single-cell fluorescence-based assays. This indirect QD labeling method, based on antibody-antigen and streptavidin-biotin interactions, is flexible enough to expand to other systems and has great potential for use in simultaneous multicolor detection schemes.

The Employees

The two company founders have PhDs in molecular biology. Each has business-relevant first and second degrees; firsts in chemical engineering and water engineering and both have management MBAs. The remaining 6 employees are all qualified to second degree level; their degrees include nanotechnology production, international technology marketing, business management and accounting.

The Funding

Using a combination of university and national grants, the two partner founded Koli-Klere in 2014. Following science grants of over €3 million and a number of international science awards the company has recently won support from one of Turkey's largest family-owned industrial groups who are prepared to back the idea through to production if the concept can be fully proven. A major international bottled water company has also expressed a strong interest in installing the equipment in their 150 water bottling plants worldwide.

Stage of Development

Successful prototypes of the bacteria capturing device have been developed for use with water. The company has already had approaches from Shell Petroleum to consider the capture of non-organic microscopic particles in fuel oils, but the two directors have chosen to remain concentrated on ecoli bacteria detection in water so that the concept can be fully proven in industrial situations. Koli-Klere has estimates for making the capturing devices in larger quantities along with the accompanying instruments for detecting the captured bacteria.

The Main Advantages of the Koli-Klere System to Users

Conventional water testing involves taking samples and then growing them in petri dishes under accelerated laboratory conditions. After 5 days the dishes are checked and any bacterial growth is identified by microscope. Based on these results, quarantined batches of bottled water are either released for sale or destroyed. Koli-Klere's new unit allows samples to be taken from production lines and the accompanying detector instrument gives an immediate indication of any problem. This both saves contaminated water being used for bottling and reduces the need to hold quarantine stocks for ecoli checks. It has been estimates that in one medium-sized plant alone this could save up to €1 million per year in warehousing, held stock and wastage. With over 40 bottling plants in Turkey, the product has significant national and international potential.

The Advantages to Koli-Klere as a Business

Once the system has been adopted, Koli-Klere will have an on-going business in supplying the disposable cartridges and in servicing/replacing the detection equipment. It has been estimated that after 5 years the company will have an annual turnover in excess of €50 million.

Intellectual Property

Koli-Klere owns international patents on the process. There are no other parties involved in the product and the company intends to proceed with SMEI II as a single applicant.

Results to Date

The prototype units have successfully completed tests with three major bottled water companies. Results show that the system is more effective than laboratory-based methods, potentially saving on waste water, but there is little saving in stock quarantine times.

Next stages

The company envisage three stages as follows:

- Further testing to prove the reliability and repeatability of the system
- Full investigation into commercialising the product
- Developing R&D, production and marketing strategies to complete the commercialisation

A budget of €1.5 million is envisaged to complete this work through SMEI and a schedule of person-months is attached, along with a Gantt chart of key Milestones.

Note: these last two documents are NOT attached