CtrlAQUA

Automatic on-site real-time identification of any disease in fish and production water

RESEARCH QUESTION:

To be able to perform automatic identification of any disease in fish and production water. Recently it has been confirmed that any eDNA or eRNA in production water will report on any of the disease related molecular events in the fish (Littlefair et al., Mol Ecol Resour. 22:2928-2940. 2022.) Our plan during this SFI period was to secure automatic collection of samples, filtration, treatment, purification of DNA/RNA and amplification and detection. The plan was to make an automatic instrument with disposable cassettes (the Fordetect system) that could perform automatic hands-free control of disease over a period of up to 6 weeks. The accuracy of the system should secure early prevention of any disease.

DURATION: 2015-2023

FISH SIZE TESTED: Any size of the fish

SALINITIES TESTED: Salt water, brackish water, fresh water

HIGHLIGHTS:

During the SFI period we have initiated the following number of processes:

1. A system for automatic pooling of water samples on production facility - this includes also the possibility to collect sample from one and one fish within the production.
2. A system for performing pre-filtration of up to 5 liters of water from the pooled samples has been tested.
3. A system for automatic cleaning of the pipes or tubes used for collection of water - already off the shelf solution.
4. A system for filtration on the top of the Fordetect cassette to collect any biological particles in the water has been designed and tested.
5. A system for automatic feeding of the cassette into the Fordetect instrument has been suggested, modifying an already established commercial product.
6. A system for automatic Fordetect prototype system for sample preparation, treatment, purification of DNA and RNA and amplification and detection at the TRL level 5 has been made. A process for making the first pilot product has started in the beginning of 2023 - this will be correlated with the establishment of the first test production line.
7. The work to develop a system for automatic reporting data from the Fordetect prototype system has started.

RECOMMENDATION:

- Any partner in the SFI consortium that would like adapt this Fordetect system to any of their challenges are welcome to participate in the program to develop and produce a pilot product.

The factsheet is not yet ready for implementation. More testing under commercial conditions is needed.

READ MORE:

Littlefair, et. al Molecular Ecology Resources 22:2928-2940. 2022

Gulliksen A, Keegan H, Martin C, O'Leary J, Solli LA, Falang IM, et al. Towards a ""Sample-In, Answer-Out"" Point-of-Care Platform for Nucleic Acid Extraction and Amplification: Using an HPV E6/E7 mRNA Model System. J Oncol. 2012;2012:905024.

Baier T, Hansen-Hagge TE, Gransee R, Crombe A, Schmahl S, Paulus C, et al. Hands-free sample preparation platform for nucleic acid analysis. Lab Chip. 2009;9(23):3399-405.

Jothinarayanan, N. Roseng L.E. and Karlsen, F. New enabling technology for on-site real-time molecular control. To be Submitted 2023. (A summary may be provided)

Utvikler miljølab på liten brikke. Teknisk Ukeblad 0922, s 83-86

Automatic Surveillance System for AQUACULTURE

Automatic on-site purification of RNA/DNA Amplification and Detection of Indicator gene activity

Biomarker testing looks for specific marks on genome from organisms

Automatic transfer of data to operation unit

Automatic filtration or dynamic separation, concentration and sorting of species to be detected (optional)

Sample collection

Data analyses
Actions if necessary
Sequencing
Additional tests
Reporting to higher level

PROCEDURE:
1. Collection of sample from fish or litres of water; separation and concentration and sorting of biological particles or cells – SEPREF (USN Technology) or normal micro- or nano filter Technology
2. Transfer of sample into the disposable cassette
3. Insertion of cassette into the measurement instrument
4. Automatic sample Processing and RNA purification – For direct automatic whole genome sequencing or
5. Automatic Amplification and Analyses of expression from 32 different indicator genes
6. Transfer of data and warnings if any event is detected
7. Direct early intervention, treatment of challenge or further analyses if necessary