



Application Note AN-PAN-1031

Le peroxyde d'hydrogène comme agent d'épouillage dans les exploitations salmونيّcوّles

Salmon farms have become more popular in the past several years. Our ever-growing population has increased the demand for salmon which influences their cultivation. In these aquatic farms, the fish live in limited space in open net cages. Parasites such as salmon lice can multiply quickly due to the high density of fish. One possibility to combat lice infestation is to use baths with dilute concentrations of hydrogen peroxide (H_2O_2) as a delousing agent. The salmon are treated in these baths for up to 20 minutes until the lice detach and die.

While it is true that hydrogen peroxide decomposes

relatively quickly, it can be deadly for salmon in high amounts. The concentration must therefore always lie within strict specifications during treatment.

This Process Application Note details the online analysis of H_2O_2 in the salmon treatment bath. The 2060 TI Process Analyzer from Metrohm Process Analytics requires less than two minutes per titration analysis. This online process analyzer helps keep the salmon healthy and safe during treatment by permitting more concentration determinations in less time than manual analysis and always guaranteeing the correct H_2O_2 dosage.

INTRODUCTION

The industrial farming of plants and animals for human consumption is nothing new, although generally this is done on land (agriculture). Aquaculture is the equivalent to agriculture in terms of growing animals and plants for food, but farmed from water sources. Salmon farming has grown in popularity over the years, from the coasts of Norway and Scotland to as far away as New Zealand, Chile, and Alaska [1]. The process of growing salmon is contained either in a net or pond and is controlled

from egg to market (**Figure 1**). An unfortunate side effect of holding such a large volume of fish in a contained area is the proliferation of salmon lice (*Lepeophtheirus salmonis*), which must be killed off (delousing) for a healthy population of fish to survive. The parasites attach to and feed off of the salmon, causing anemia and even death. The lice can spread quickly during the grading and harvesting processes because of the large disturbances caused.

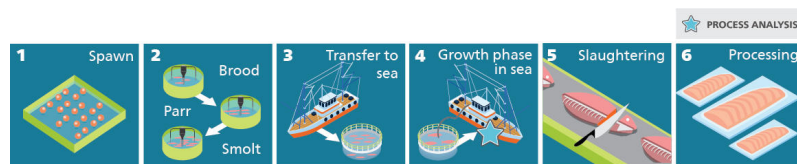


Figure 1. Illustration of the Atlantic salmon production process at an aquatic farm (repurposed from [1]).

INTRODUCTION

One of the salmon delousing treatments available is hydrogen peroxide (H_2O_2). A diluted bath of H_2O_2 is prepared in which the fish are introduced for up to 20 minutes, and this removes the attached parasites, which can then be filtered from the water. The benefits of using H_2O_2 are numerous – it is easy to purchase, it is a non-medicinal treatment, and it rapidly degrades into water and oxygen as byproducts.

Challenges remain regarding the efficiency of dosing, mixing, and the distribution of H_2O_2 in the salmon

treatment tank to prevent overdosing, which can cause oxidative stress in the fish, the bleaching of skin/scales, and even death. Therefore, quick analysis and response times are critical. The Metrohm Process Analytics 2060 TI Process Analyzer (**Figure 2**) can monitor the concentration of H_2O_2 and be used to control the dose rate accurately into the salmon treatment tank, ensuring that the delousing treatment process runs within specifications. These online process analyzers are currently in use at several salmon farms.



Figure 2. 2060 TI Process Analyzer used for online monitoring of hydrogen peroxide in salmon delousing baths.

The H_2O_2 concentration is measured titrimetrically with cerium (IV) using a Pt-ring electrode and reference electrode (Ag/AgCl/KCl) to determine the endpoint with dynamic endpoint titration (DET). The

analysis frequency is fully optimized, and the typical analysis time is less than two minutes, ensuring timely control of the H_2O_2 concentration in the bath.

Table 1. Hydrogen peroxide concentration range used in the delousing process at salmon farms.

Parameters	Concentration [g/L]
H_2O_2	0–2500

REMARKS

Other process applications are available for this industry including the determination of alkalinity,

calcium, water hardness, free fatty acids (in fish oil), iron, phosphate, and many more.

A wide range of hydrogen peroxide concentrations in salmon farm delousing baths can be measured online quickly and reliably using the Metrohm Process Analytics 2060 TI Process Analyzer. Furthermore, this

analyzer can provide automated analysis results for the salmon treatment tank, avoiding overdosing, which can cause oxidative stress in the fish, skin/scale bleaching, and death.

RELATED APPLICATION NOTES FOR THE FOOD & BEVERAGE INDUSTRY

[AN-PAN-1029 Peracetic acid \(PES\) as disinfectant for PET bottles](#)

[AN-PAN-1054 Online monitoring of hydrogen peroxide during the CMP process](#)

[AN-PAN-1055 Monitoring quality parameters in](#)

[standard cleaning baths](#)

[AN-T-025 Hydrogen peroxide content in aqueous solutions](#)

[AN-NIR-095 Quality Control of Hand Sanitizers](#)

RELATED DOCUMENTS

[Brochure: Fishery & Aquaculture – reliable online, inline, and atline analysis systems for optimizing](#)

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[Brochure: 2026 Hydrogen Peroxide Analyzer](#)

BENEFITS FOR ONLINE ANALYSIS OF DELOUSING

- Detect treatment upsets quickly (e.g., incorrect chemical dosing) via automated analysis
- Improved manufacturing efficiency (avoid lower fish yields and harvesting disturbances)
- Monitor multiple treatment baths (up to 10) for more savings per measurement point and results



REFERENCES

1. *Salmon Farming Industry Handbook 2021*; Mowi Industry, 2021.

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CONFIGURATION



2060 Process Analyzer

Le 2060 Process Analyzer est un appareil d'analyse par voie humide online adapté à un grand nombre d'applications. Cet appareil d'analyse de processus propose un nouveau concept de modularité reposant sur une plate-forme centrale, dénommée « armoire de base ».

Cette armoire de base se compose de deux parties. La partie supérieure contient un écran tactile et un PC industriel. La partie inférieure contient la partie humide flexible dans laquelle est logé le matériel nécessaire à l'analyse en elle-même. Si la capacité de base de la partie humide n'est pas suffisante pour résoudre un problème d'analyse, vous pouvez ajouter jusqu'à quatre armoires de partie humide supplémentaires à cette armoire de base afin de disposer de suffisamment d'espace pour résoudre les applications les plus difficiles. Les armoires supplémentaires sont configurables de manière à ce que chaque armoire pour partie humide puisse être combinée à une armoire à réactifs avec détection de niveau intégrée (sans contact) afin d'augmenter la disponibilité de l'appareil d'analyse.

Le 2060 Process Analyzer propose différentes techniques de chimie par voie humide : le titrage, le titrage Karl Fischer, la photométrie, la mesure directe et des méthodes d'addition standard.

Pour répondre à toutes les exigences de projet (ou à tous vos besoins), des systèmes de préconditionnement d'échantillons peuvent être fournis afin de garantir une solution analytique robuste. Nous pouvons pour ainsi dire fournir tout système de pré-conditionnement d'échantillon, tels que refroidissement ou chauffage, réduction de la pression, dégazage, filtration et bien plus encore.