Anses scientific and doctoral days

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Impact of the smoked salmon manufacturing process on the physiological state of *Listeria monocytogenes*

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BACKGROUND

Listeria monocytogenes is a pathogen that can be found in **ready-to-eat foods** such as smoked salmon. Its ability to grow in finished products is a critical parameter for consumer safety and can be assessed using a **challenge test**. During the smoked salmon manufacturing process, *L. monocytogenes* is exposed to **stressful conditions** that impacts its **physiological state**. Risk may be misestimated if the difference in physiological state from the growth test inoculum is too great.

The aim of this study is to reproduce *in vitro*, the physiological state of a natural contamination by testing different stress conditions.

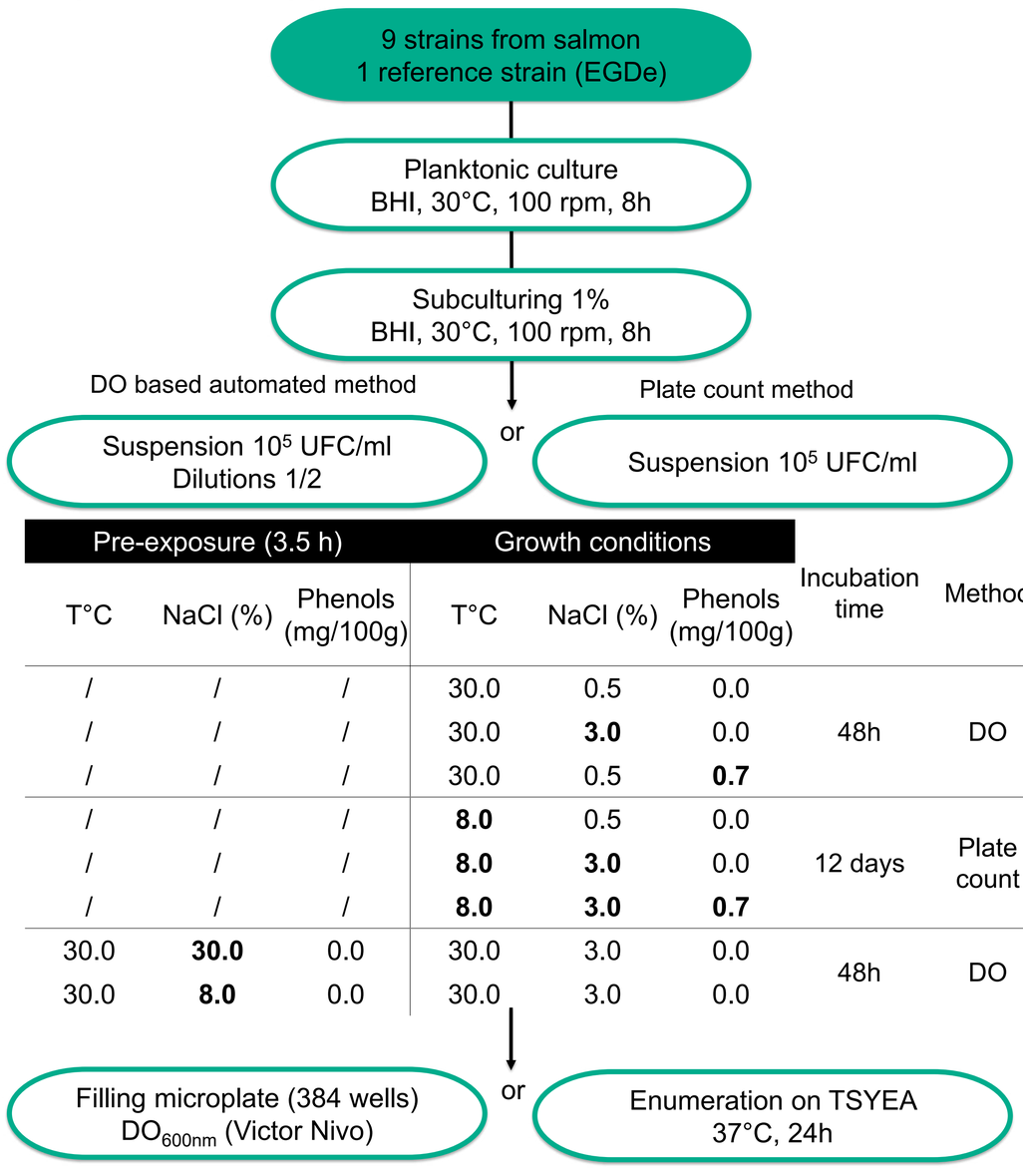
MATERIALS AND METHODS

The tree stressful conditions studied correspond to stages in the salmon transformation process

- **Salting** (3% NaCl)
- **Smoking** (smoked at 0.7 mg/100g)
- **Factory floor temperature** (8°C)

An optimal condition was tested (30°C, 0.5% NaCl, no smoke). Stressful conditions were tested individually, then cumulatively (8°C + 3% NaCl **and** 8°C + 3% NaCl + 0,7 mg phenols/100g). Pre-exposure to high salt levels was evaluated (8% then 3% and 30% then 3%). All growth tests were carried out in BHI.

To date, the physiological state of *L. monocytogenes* is assessed by growth parameters. **Figure 1** describes the experimental approach used.



Pre-exposure (3.5 h)			Growth conditions				
T°C	NaCl (%)	Phenols (mg/100g)	T°C	NaCl (%)	Phenols (mg/100g)	Incubation time	Method
/	/	/	30.0	0.5	0.0		
/	/	/	30.0	**3.0**	0.0	48h	DO
/	/	/	30.0	0.5	**0.7**		
/	/	/	**8.0**	0.5	0.0		
/	/	/	**8.0**	**3.0**	0.0	12 days	Plate count
/	/	/	**8.0**	**3.0**	**0.7**		
30.0	**30.0**	0.0	30.0	3.0	0.0	48h	DO
30.0	**8.0**	0.0	30.0	3.0	0.0		

Figure 1: Experimental approach to assess the impact of conditions on growth parameters.

RESULTS

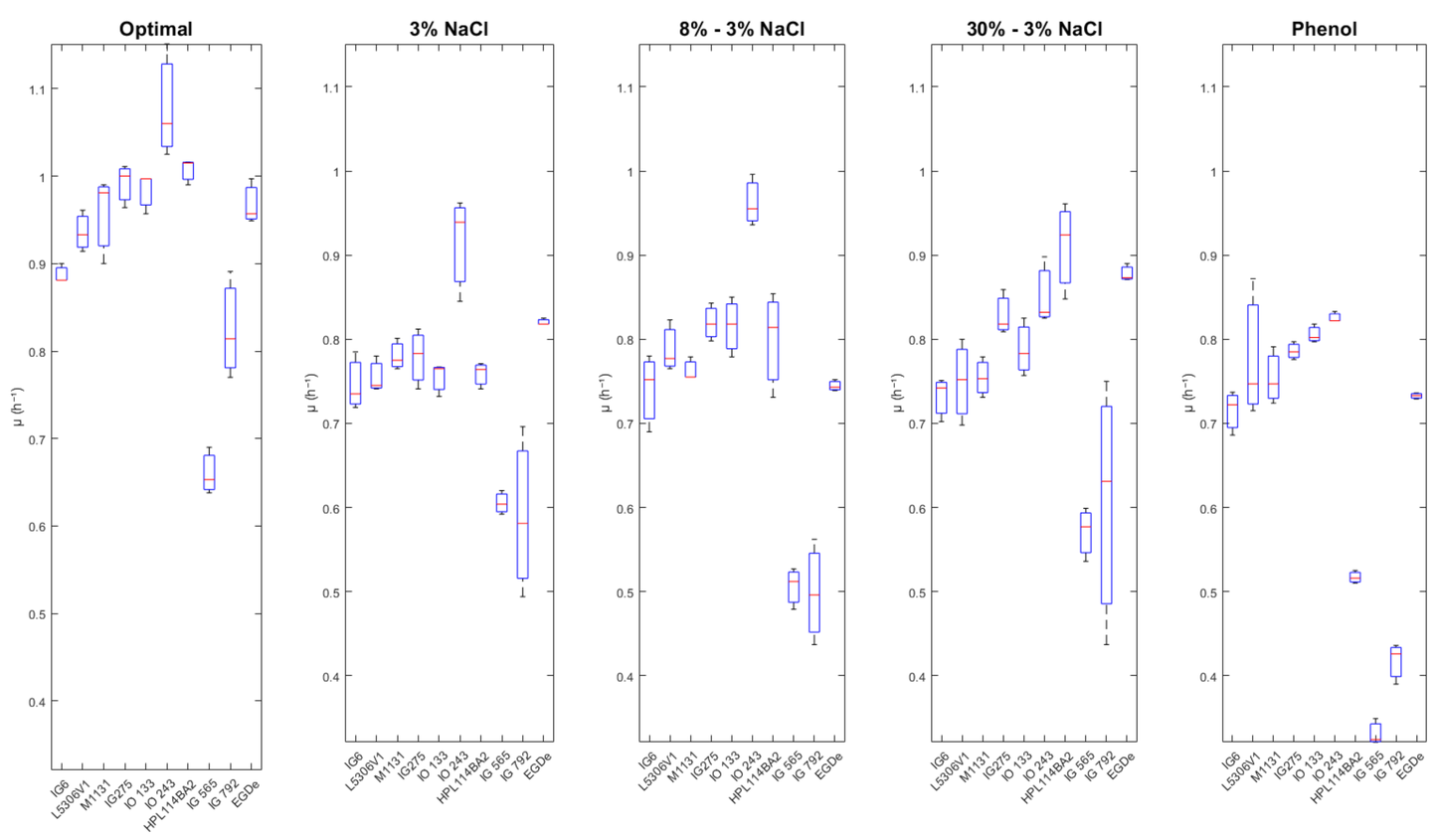


Figure 2: Growth rates of 10 *L. monocytogenes* strains under 5 processing conditions representative of smoked salmon production (n=3).

Figure 2 shows the **diversity of growth rates** depending on the stressing condition. **High inter-strain variability is observed**. High pre-exposure to salt has no significant impact on the growth rate compared to single exposure.

The coefficients of variation obtained in conditions: optimal, NaCl, pre-exposure (8% and 30%) and smoke are respectively, 12.55%, 12.61%, 19.06%, 14.46% and 26.60%.

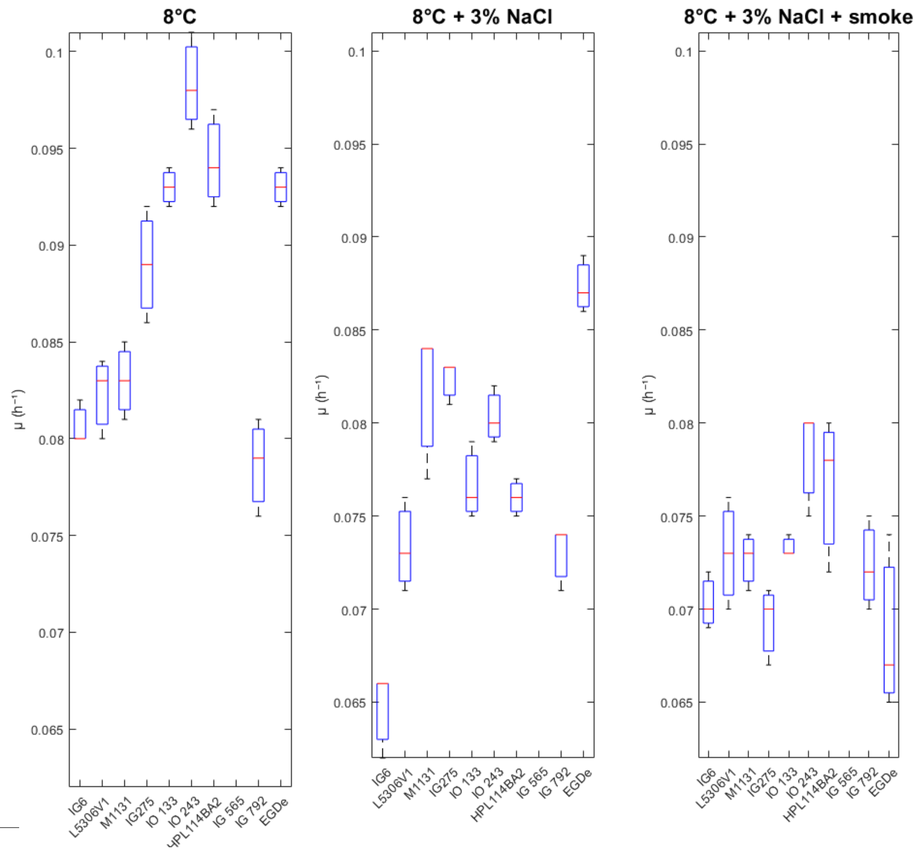


Figure 3: Growth rates of 10 *L. monocytogenes* strains under 3 processing conditions representative of smoked salmon production (n=3).

Figure 3 highlights a **lower intraspecific diversity** in *L. monocytogenes* growth rates across different stress conditions.

Indeed, coefficients of variation for 8°C, 8°C + 3%NaCl and 8°C + 3%NaCl + smoke are respectively 7.99%, 8.56% and 4.38%. Strain IG565 is not able to growth at 8°C.

Accumulation of stressful conditions induces the lowest growth rates of *L. monocytogenes*.

CONCLUSION AND PERSPECTIVES

These results show the **importance of intraspecific variability** in growth rates under different stressful conditions related to the manufacturing process of smoked salmon. **Accumulation of stressful conditions** decreases strain growth rates. Condition 8°C + 3%NaCl + smoke, has the lowest growth rates.

The next step is to evaluate the effect of these stressful conditions on *L. monocytogenes* **transcriptome**.

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