Microbial spoilage association and volatiles production during the storage of sea-bream fillets stored aerobically and under MAP at 0ºC

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Aim: To monitor the microbial spoilage population changes and volatile compounds profiles during the chill storage of aquacultured sea-bream (*Sparus aurata*) fillets under air and MAP.

Experimental

Samples of sea-bream fillets stored at 0ºC under air and MAP conditions ($CO_2/O_2/N_2$:60/10/30) were taken for sensory, microbiological and volatiles analysis. Population changes of spoilage bacteria were monitored by using selective media. Volatiles were determined using SPME GC-MS analysis.

Compounds were identified by comparison with reference substances based on the following criteria: RI (retention index) and ms (mass spectrum) obtained from standard and MS (mass spectrum) from NIST library. Semi-quantification took out calculated from absolute area under the peak.

Results

Shelf-life was 13 and 17 d for aerobically and under MAP respectively. Counts on CFC were the predominant micro-biota at the end of shelf-life, in both products. (Figure 1).

Several volatile compounds were found to change during storage, while other showed clear similarities or differences between storage in air and storage under MAP. Various compounds that were detected like 2-heptanone, 3-hydroxy-2-butanone, 1-penten-3-ol, have been reported in the literature as bacterial metabolites, while others like cis-4-heptanal, 1-octen-3-ol, have been reported as products of chemical activity (Table 1).

Conclusions

Different atmospheric conditions affected not only the shelf-life but also the spoilage micro-biota and consequently the volatiles profile. Additional work is required to confirm which of the volatile compounds detected, were microbial metabolites in order to be used as potential chemical indices of sea-bream fillets spoilage/freshness.

Significance of study

The present study provides valuable information which can be used for the identification of potential chemical indices for rapid quality assessment and estimation of the remaining shelf-life.

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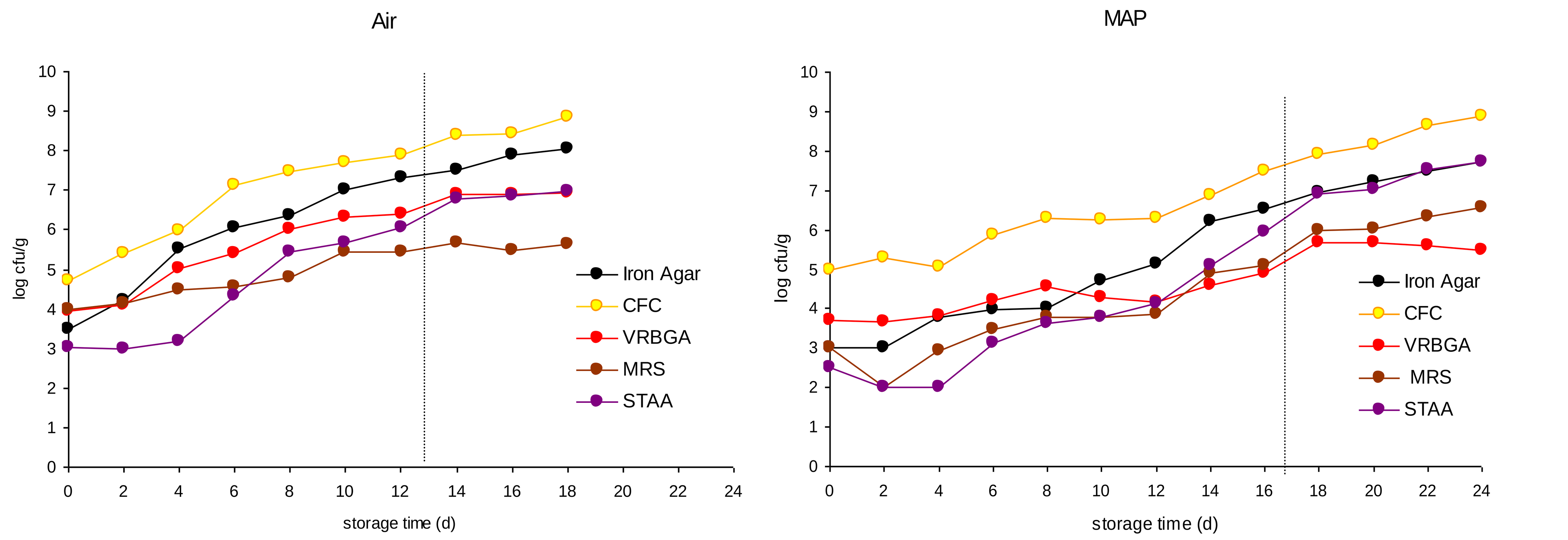

Figure 1. Population changes of spoilage microorganisms. The vertical line indicates the rejection time point of the product.

Table 1. Volatile compounds detected during the chill storage of sea-bream fillets under air and MAP. nd: not detected

Volatiles compounds	Map 0ºC (area under the peak 10^{-6})							Air 0ºC (area under the peak 10^{-6})			
	day 0	day 4	day 8	day 12	day 16	day 20	day 24	day 4	day 8	day 12	day 16
Ethyl alcohol	1.585	1.752	1.549	2.048	3.732	0.831	0.895	4.103	4.622	1.410	2.460
acetic acid	0.046	0.450	0.126	0.164	0.142	nd	0.238	nd	nd	nd	nd
3-Methylbutyraldehyde	0.021	nd	nd	nd	0.656	nd	1.009	0.060	0.045	0.077	0.462
2-Methyl-butyraldehyde	nd	nd	nd	nd	0.231	nd	0.484	nd	nd	nd	nd
1-Penten-3-ol	2.333	0.279	0.483	1.800	1.987	0.400	1.533	12.906	3.726	3.519	6.143
Acetyl propionyl (2,3-Pentanedione)	0.643	0.020	0.087	0.184	nd	nd	nd	nd	0.550	nd	1.125
3-Pentanone	0.167	0.009	nd	nd	nd	nd	nd	0.234	0.162	1.614	2.963
3-Hydroxy-2-butanone	nd	nd	nd	nd	nd	nd	0.161	nd	nd	nd	nd
Isoamyl alcohol	nd	nd	nd	nd	nd	nd	0.243	nd	nd	nd	nd
2-Pentenal-(E)	nd	nd	nd	nd	nd	nd	nd	0.065	0.004	0.044	0.005
Amyl alcohol	0.038	nd	nd	0.025	nd	nd	nd	0.076	0.084	0.134	0.065
2-Penten-1-ol (Z)	0.161	nd	nd	0.125	0.152	nd	nd	0.463	0.208	0.136	0.076
Hexenal	5.099	0.774	1.245	2.780	0.984	nd	0.916	4.627	1.555	2.027	nd
Hexanal	nd	nd	nd	nd	nd	1.063	nd	nd	nd	nd	0.750
Ethyl 2-methylbutyrate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.291
Ethyl isovalerate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.476
trans-2-Hexenal	0.014	nd	nd	nd	nd	0.080	nd	0.035	0.008	0.028	nd
1-Hexanol	0.048	nd	nd	nd	nd	nd	0.196	0.035	0.008	0.028	nd
2-Heptanone	0.006	nd	nd	nd	nd	nd	nd	0.033	0.025	0.017	0.036
cis-4-Heptenal	0.347	0.203	0.496	0.719	1.150	0.441	0.222	0.768	0.389	0.427	0.200
Heptanal	0.197	0.013	0.061	0.118	nd	0.081	0.089	0.018	0.074	0.074	0.045
Butenoic acid, 2-methyl-ethyl ester, (E)-	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.397
2-Propanol, 1-butoxy	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.135	0.101
Methyl caproate	nd	nd	nd	nd	nd	0.031	nd	nd	nd	nd	nd
trans-2-Heptenal	0.027	0.088	nd	nd	nd	nd	nd	0.022	nd	0.026	nd
1-octen-3-ol	0.629	0.172	0.609	0.827	0.990	0.618	0.749	0.488	0.566	0.799	0.595
Hexanoic acid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Octanal	0.170	nd	nd	nd	nd	nd	nd	0.068	0.072	0.035	0.022
trans,trans-2,4-Heptadienal	nd	0.173	0.141	0.090	0.029	0.118	0.025	nd	nd	nd	nd
n-Decane	nd	0.028	0.014	0.090	nd	nd	nd	nd	nd	nd	nd
Octanal	0.170	0.076	0.087	0.116	nd	0.107	0.105	nd	nd	nd	nd
2-Ethyl-1-hexanol	1.587	0.033	0.120	0.390	0.086	0.188	0.269	1.671	1.197	1.377	1.264
trans-2-octenal	nd	0.079	0.037	0.058	nd	0.052	0.090	nd	nd	nd	nd
3,5-Octadien-2-one (E)	0.102	0.129	0.286	0.536	nd	0.694		0.248	0.137	0.182	0.186
n-Undecane	0.155	0.032	nd	nd	nd	nd	0.069	0.038	0.086	0.044	0.002
2-Nonanone	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.103
cis-6-Nonenal	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.424
Nonanal	0.252	0.271	0.224	0.295	0.226	0.183	0.172	0.036	0.080	0.102	0.051
trans-2-Nonenal	nd	0.055	nd	nd	nd	nd	0.116	nd	nd	nd	nd
n-Dodecane	0.024	nd	0.018	0.028	0.033	nd	nd	0.008	0.099	0.007	0.050
n-decanal	0.019	0.043	0.029	0.028	0.021	nd	0.016	nd	0.008	nd	nd
2(E)-Decenal	0.029	0.346	0.196	0.097	0.091	0.073	0.086	nd	0.022	nd	nd
1-Decanol	0.033	0.015	0.029	0.029	nd	0.028	0.019	nd	nd	nd	nd
2,4-Decadienal (E,E)	nd	0.541	0.220	nd	0.072	nd	0.039	nd	nd	nd	nd
n-Tetradecane	0.123	0.078	0.071	0.099	0.073	0.088	0.068	0.031	0.074	0.039	0.054
Pentadecane	1.181	0.651	0.824	0.949	0.772	0.793	0.712	0.418	0.586	0.379	0.424
n-Hexadecane	nd	0.082	0.167	nd	0.137	0.105	0.110	nd	nd	nd	0.020
n-Eicosane	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.489
n-Tetracosane	1.080	1.047	0.806	1.114	0.658	1.119	0.588	0.717	0.651	0.500	nd