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Correlation analysis for screening key parameters for fish canning wastewater characterization

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1. Introduction – A significant number of food industries do not have a proper wastewater treatment; fish canning is no exception, and the existing pre-treatment is insufficient, given the content of organic matter, oil and grease and salinity. In addition, this type of wastewaters shows high variability depending on the type of processes involved and effluent streams being discharged [1]. For this reason, its characterization is very important to conceive and implement the correct wastewater treatment layout. In this work, correlation analysis was used to identify the relationship between each wastewater parameter analyzed. Correlation coefficients between each parameter reflect their importance compared to others.

2. Experimental – Twenty wastewater samples were collected from a fish canning industry of northern Portugal and characterized in terms of 19 physicochemical parameters [2]. Correlation analysis was performed according to Pearson Product Moment Correlation using a R multivariate data analysis software package.

3. Results and Discussion – Table I shows the correlation matrix achieved between all the 20 fish canning wastewater samples after normalization. The closer the correlation coefficient is to 1 the more similar the two variables are. Highlighted values correspond to statistically significant correlation coefficients (p-Value < 0.05).

Table I. Correlation matrix between all parameters to characterize fish canning industry wastewaters.

	Conductivity	pH	TSS	VSS	DOC	COD	BOD_5	P_{total}	$N_{total\ soluble}$	Oil and grease	F^-	Cl^-	NO_2^-	SO_4^{2-}	NO_3^-	PO_4^{3-}	Na^+	NH_4^+	Ca^{2+}
Conductivity	1.00																		
pH	0.04	1.00																	
TSS	-0.24	0.06	1.00																
VSS	-0.11	0.16	0.86	1.00															
DOC	0.13	-0.08	0.45	0.28	1.00														
COD	0.13	0.20	0.60	0.73	0.10	1.00													
BOD_5	-0.26	0.14	0.73	0.51	0.29	0.50	1.00												
P_{total}	0.21	0.04	0.30	0.19	0.63	0.17	0.45	1.00											
$N_{total\ soluble}$	0.17	0.08	0.41	0.21	0.83	0.24	0.29	0.64	1.00										
Oil and grease	0.23	-0.08	0.18	0.32	-0.08	0.49	0.11	0.35	0.09	1.00									
F^-	0.08	0.03	0.27	0.26	0.01	0.18	0.31	0.25	0.09	0.17	1.00								
Cl^-	0.90	-0.17	-0.37	-0.33	0.07	0.05	-0.21	0.18	0.10	0.22	0.02	1.00							
NO_2^-	0.34	0.07	-0.26	-0.25	0.20	-0.08	-0.01	0.35	0.08	0.07	0.13	0.42	1.00						
SO_4^{2-}	-0.13	-0.16	-0.23	-0.24	0.23	-0.39	0.05	0.16	0.11	-0.21	-0.27	0.01	0.14	1.00					
NO_3^-	-0.10	-0.26	-0.08	0.10	-0.27	0.10	-0.08	-0.22	-0.41	0.03	0.10	-0.04	-0.25	0.22	1.00				
PO_4^{3-}	0.06	-0.04	0.03	0.15	-0.08	0.11	0.24	0.28	-0.06	0.13	-0.18	0.07	-0.09	0.44	0.32	1.00			
Na^+	0.90	-0.12	-0.41	-0.37	0.07	0.03	-0.22	0.20	0.11	0.17	0.01	0.99	0.42	0.03	-0.02	0.08	1.00		
NH_4^+	0.29	-0.06	0.07	-0.05	-0.11	0.02	0.07	-0.25	-0.26	-0.17	0.11	0.30	0.16	-0.39	-0.15	-0.07	0.26	1.00	
Ca^{2+}	-0.23	0.19	0.06	0.14	-0.26	0.03	-0.22	-0.03	-0.14	0.29	0.05	-0.28	-0.19	-0.41	0.06	-0.20	-0.30	-0.21	1.00

4. Conclusions – The results achieved demonstrate that correlation analysis is a powerful tool to find relationships among many variables and to define which are the key parameters to characterize fish canning industry wastewaters, decreasing the total number of parameters to analyze.

5. References

[1] R.O. Cristóvão, C.M. Botelho, R.J.E. Martins, J.M. Loureiro, R.A.R. Boaventura, *J. Clean. Prod.,* **87**, (2015) p. 603.
[2] APHA, "Standard Methods for the Examination of Water and Wastewater", 21st Ed. Washington, DC, United States of America, 2005.