OXYGEN CONTENT ANALYSIS WITH CURRENT SENSORS

Elena Maria PICĂ, Mihaela Ligia UNGUREŞAN, Lorentz JÄNTSCHI

Technical University of Cluj-Napoca, Romania,
empica@yahoo.com,http://mihaela.academicdirect.ro, http://lori.academicdirect.ro

Abstract: The paper presents the using of current sensors in measurements of the oxygen content in the organic solutions such as beer. The resulted data it serves in a comparison with spectrophotometric data.

Keywords: current sensors, statistical analysis, oxygen content analysis

1. INTRODUCTION

We use a sensor for beer analysis. Beer is obtained by brewing the beer must, that is by transforming the fermentable sugars into alcohol and carbon dioxide with the aid of the enzyme complex of the beer yeast.

2. THE EXPERIMENT

The determining of oxygen was carried out by means of the current sensor under strict thermostatic conditions t(^{o}C) = 20±0.2. As a basic electrolyte, a carbonate – bicarbonate solution was used (KCl 0.75M; K_2CO_3 0.5M; $KHCO_3$ 0.25 M).

The calibration mixtures were air-argon, air-carbon dioxide, and water saturated air [1]. The determinations were carried out with three different sensors, achieved according to the method described in [2]. Thus, the sensitivity values according to the oxygen concentration were determined (see table).

The sensitivity values of some sensors for different argon and CO_2 air mixtures

Mixture	[O_2]	Sensor 1		Sensor 2		Sensor 3	
	[ppm]	i[µA]	S [µA/ppm]	i[µA]	S [µA/ppm]	i[µA]	S [µA/ppm]
Argon - air	1.83	0.213	0.1163	0.294	0.1607	0.317	0.1732
	4.30	0.504	0.1172	0.691	0.1607	0.745	0.1733
	5.90	0.687	0.1164	0.947	0.1605	1.022	0.1732
	8.47	0.986	0.1164	1.359	0.1604	1.466	0.1731
CO_2 - air	1.98	0.231	0.1167	0.318	0.1606	0.343	0.1732
	4.52	0.526	0.1164	0.724	0.1602	0.781	0.1728
	6.08	0.707	0.1163	1.356	0.1602	1.050	0.1724
	8.47	0.985	0.1163	1.356	0.1601	1.460	0.1724

From the data in tables 1 and 2 it is noticed that the sensors have the same sensitivity for the different mixtures of air-argon and air-carbon dioxide, the standard deviation “s” is small, the value being s = $8.55 \cdot 10^{-2}$ [ppm]. The functioning of the sensors is not influenced by the presence of the carbon dioxide.

The data obtained by the spectrophotometric method and those resulted by using the oxygen sensor were compared by means of the STAS 7688-84 method.

The obtained data are presented in the following tables. The data in the next table show a good concordance of the results obtained by the oxygen sensor compared to the STAS method, and compared to the spectrophotometric method. The two methods, the spectrophotometric, and the oxygen sensor one were applied to samples of bottled beer, produced at "Ursus" Factory (see table below).

Oxygen content with spectrophotometer (Sp), sensor (Se) and STAS method for water (STAS)

No	Water			Beer		AB Must		No	Water			Beer		AB Must	
Crt	STAS	Sp	Se	Sp	Se	Sp	Se	Crt	STAS	Sp	Se	Sp	Se	Sp	Se
1	1.83	1.83	1.83	0.53	0.52	7.02	6.95	6	2.82	2.82	2.82	0.65	0.63	7.05	6.95
2	1	1.15	0.98	1.15	1.04	7.1	7	7	2.97	3.07	2.97	0.94	0.9	7.11	7.06
3	1.65	1.76	1.64	1.08	1.02	7.3	7.2	8	0.5	0.49	0.49	1.26	1.22	7.19	7.11
4	1.12	1.2	1.12	0.96	0.9	7.2	7.16	9	0.48	0.5	0.47	0.76	0.72	7.1	7.04
5	2.4	2.46	2.42	0.83	0.79	7.1	7.04	10	2.15	2.11	2.15	0.88	0.81	7	6.98

The regression analysis of the measured data is represented in figure 1:

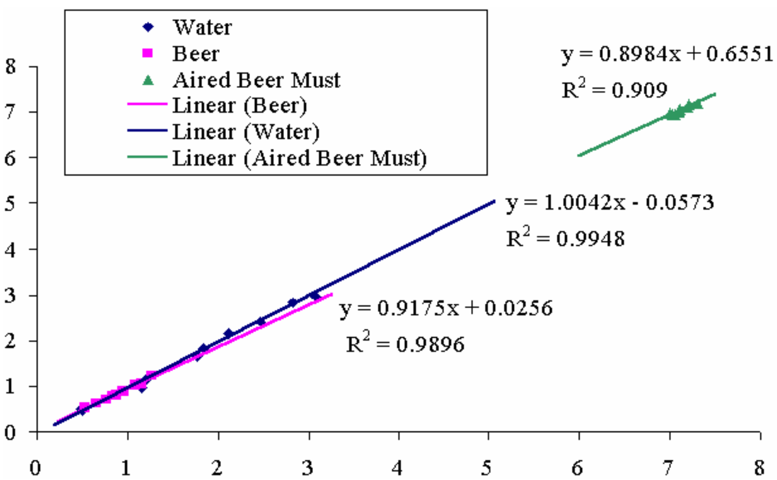

Fig. 1. Data plots of water, beer and aired beer must

3. CONCLUSIONS

The oxygen sensor can be used for determining the oxygen content along the production process, namely for controlling it (correlation coefficients ~ 0.9 and relative error ~ 0.34%).

The method employing the amperometric sensor allows for the on-line control and the automation of the process.

REFERENCES

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