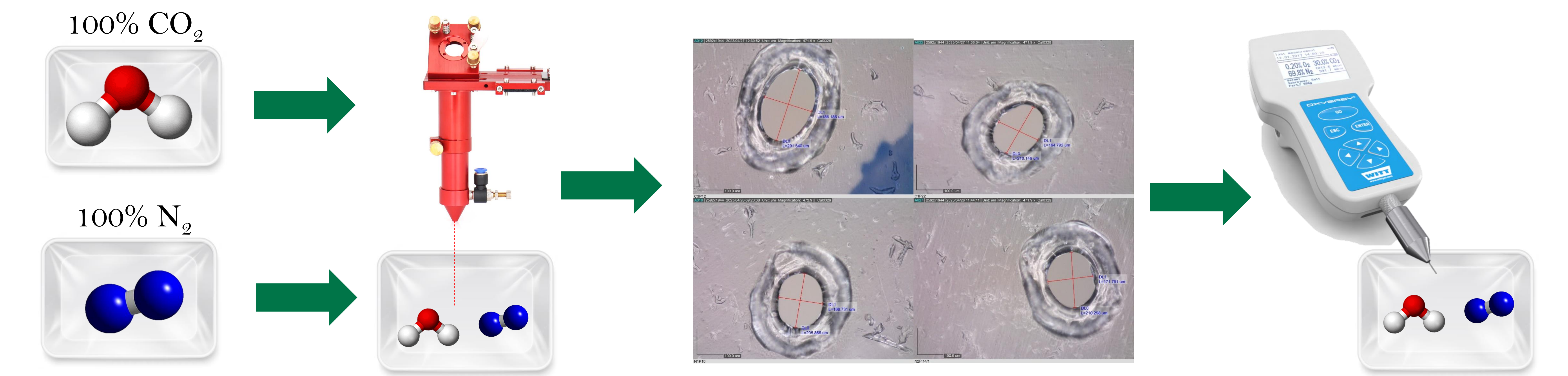
# Variation of the gas diffusion rate by changing the microperforation area of the packaging foil in modified atmosphere packaging

G. Szabó[1], Zs. Horváth-Mezofi[1], L.L.P. Nguyen[1], Z. Sasvár[1], M. Göb[1], Z. Gillay[1], T. Zsom[1], G. Hitka[1]

[1]Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, Villányi Street 35-43. 1118 Budapest, Hungary, e-mail: szabo.gergo.7@phd.uni-mate.hu

## MATERIALS & METHODS




Modified Atmosphere Packaging — Packages were Microperforated by Laser — Gas diffusion over time through microperforation(s) — Gas concentrations were measured ($CO_2$, $N_2$ and $O_2$ every 24 h for 10 days)

### Microperforations:

| | | |
|---|---|---|
| *1 small microperf. area: | AVG: 0.022 mm², | STD: 0.005 mm² |
| **2 small microperf. area: | AVG: 0.046 mm², | STD: 0.007 mm² |
| ***1 larger microperf. area: | AVG: 0.037 mm², | STD: 0.006 mm² |

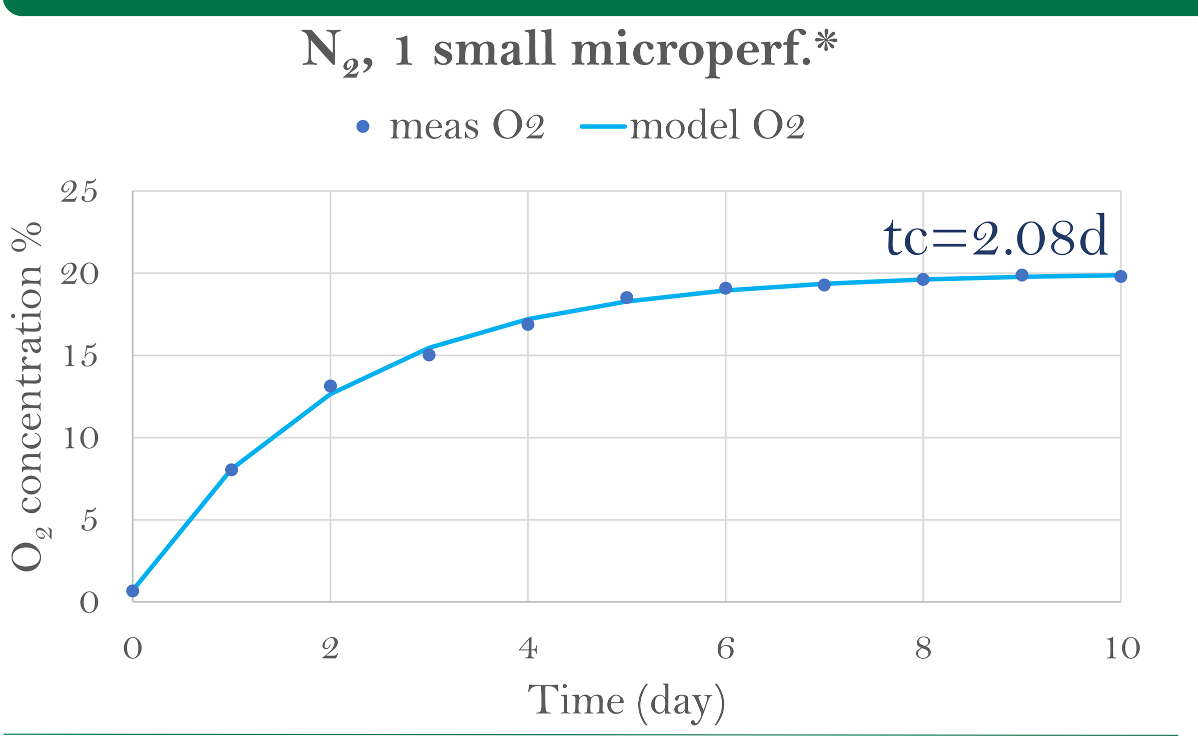
### Saturation Model:

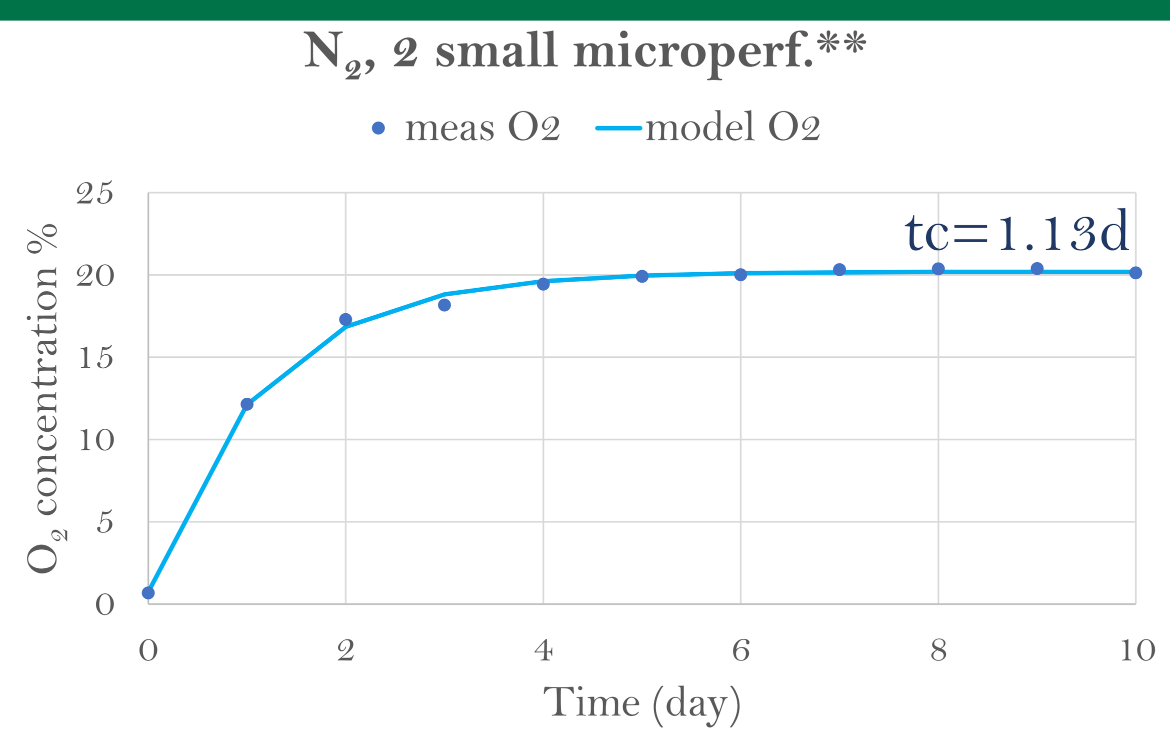
$$c = c_0 + \Delta c \cdot \left(1 - e^{\frac{t}{tc}}\right)$$

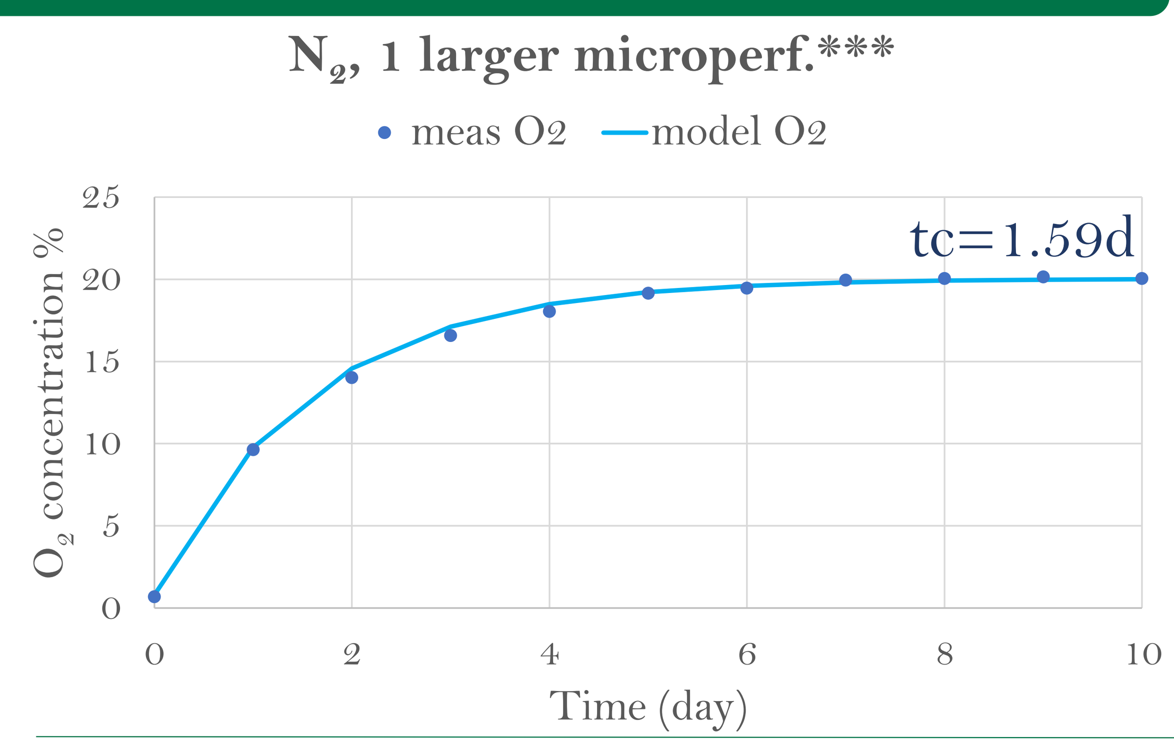
c: concentration %
$c_0$: initial concentration %
Δc: overall change
tc: time constant, t: time

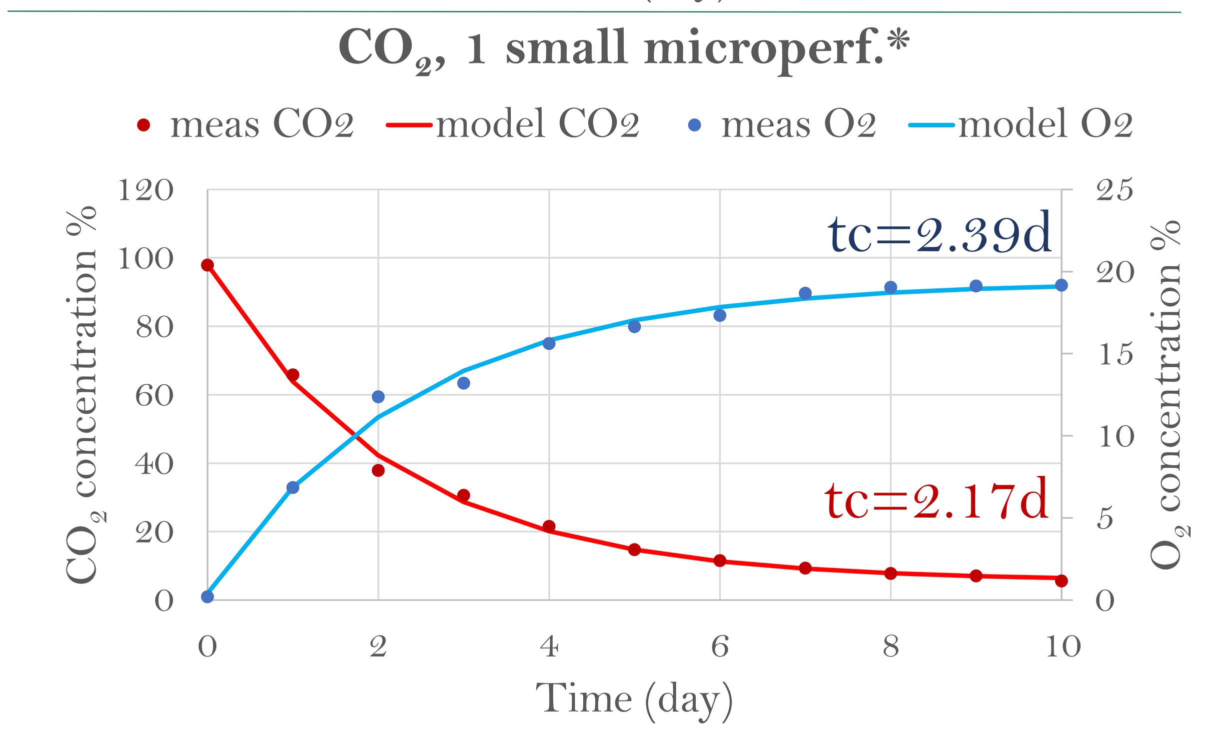
Mathematical modeling was used to determine the speed of the gas diffusion and MS Excel Solver was used to fit model on the measured data sets to determine the time constants (tc).

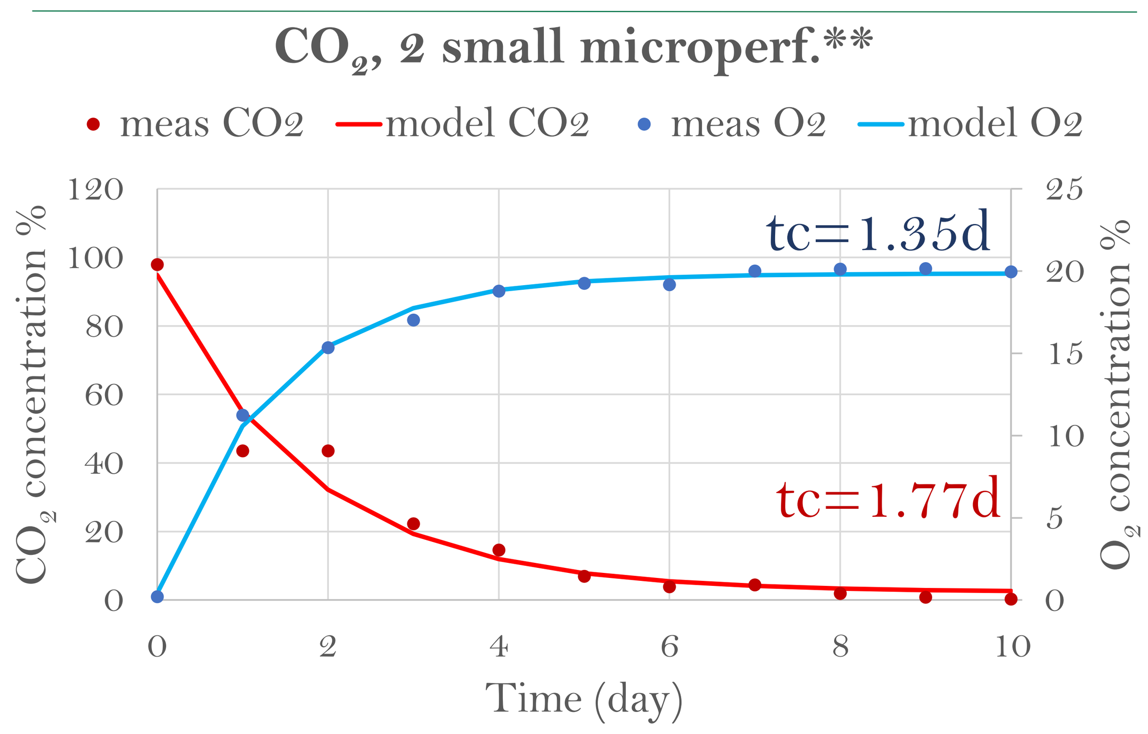
## RESULTS

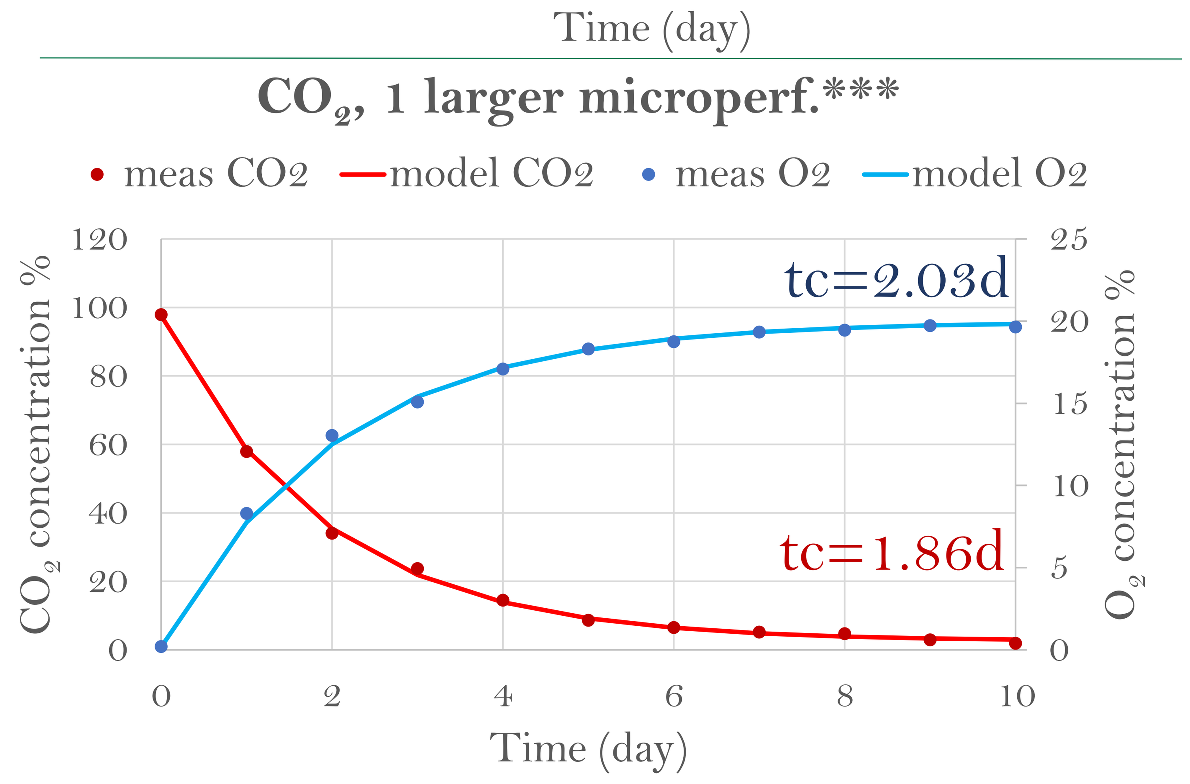



## CONSLUSION

The effects of the different microperforations were successfully described by the time constant of the chosen saturation model. The double small microperforated area casued the time constant changed from 2.08d to 1.13d for $O_2$, from 2.39d to 1.35d for $O_2$, from 2.17d to 1.77d for $CO_2$. The larger microperforated area caused smaller changes: 1.59d, 2.03d and 1.86d, respectively.

## ACKNOWLEDGEMENTS

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MAGYAR AGRÁR- ÉS ÉLETTUDOMÁNYI EGYETEM

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