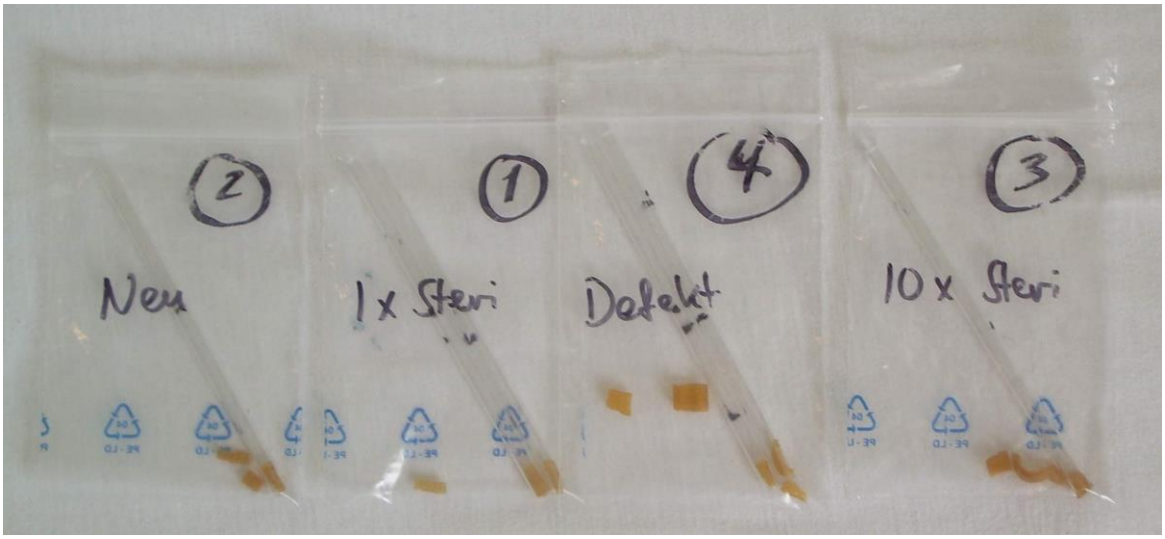
Defects Identification in Trachea Tubes (revised in 2012)

Trachea tubes from high-quality natural rubber are dedicated to human lungs drainage. They are can not be processed in a boiler for a sterilization purpose to be used more than one time. It leads to tubes damages and as a possible result to dangers for health and life of a patient. It seems that there is no technique which can unambiguously assert how much times a tube system has been processed.

The task of survey: to find the difference in the input samples by means of low field NMR (Nuclear Magnetic Resonance).



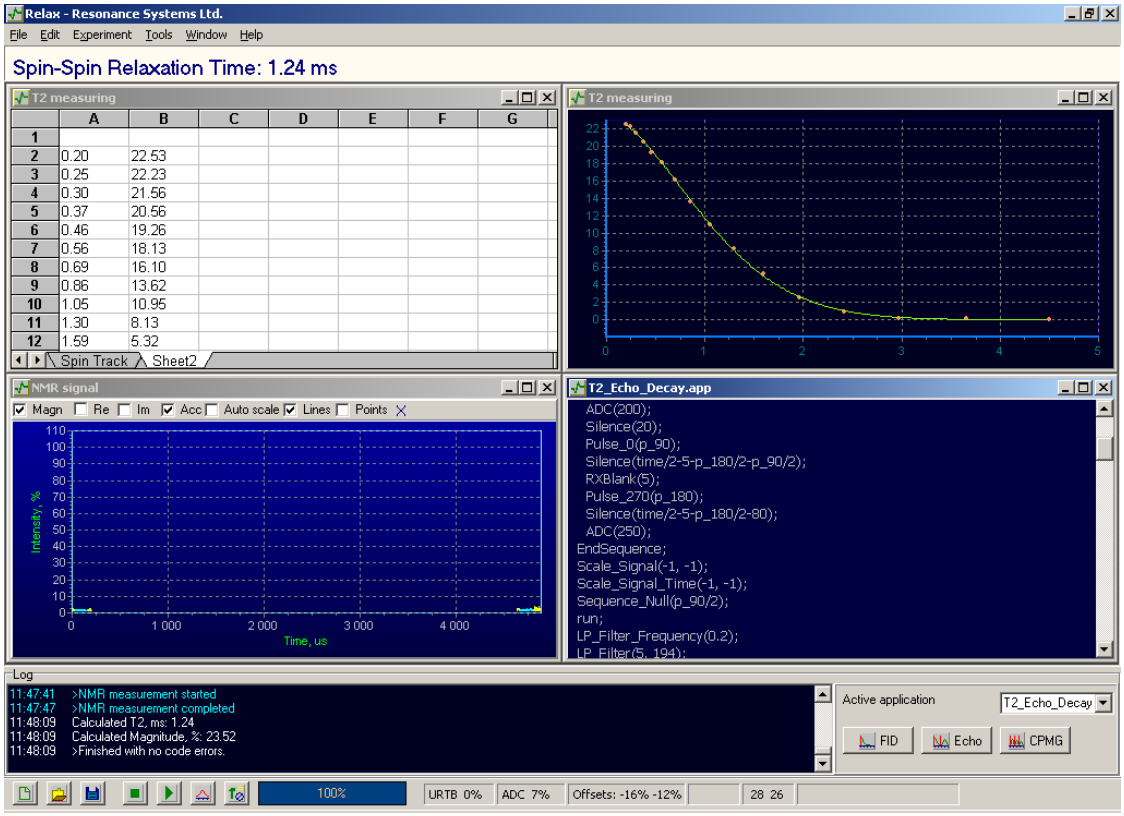
Photos of the samples: cuts of trachea tubes after different studies of processing

Measuring System:

Spin Track TD-NMR spectrometer – Portable realization;

5-mm tube sensor with ^{1}H NMR frequency of 15.75 MHz (See photo below)

Software: Relax V6.15 (Resonance Systems)



Method:

Measuring of T_2 (Spin-Spin Relaxation Time) by the Hahn Echo Decay. Samples were cut to the small sizes to fit within 5-mm glass ampoule (See the first photo).

Results:

Sample:	New	1 time processed	10 times processed	defect
T_2, ms	1.31	1.27	1.28	1.19
	1.3	1.25	1.25	1.15
	1.27	1.26	1.24	1.19
	1.28	1.27	1.23	1.21
Mean T_2, ms	**1.29**	**1.2625**	**1.25**	**1.185**

The T_2 of samples that is proportional to the molecular stiffness slightly goes down with the increase of amount of sterilizations. The “defect” sample has got the minimum mobility of internal hydrogen nuclei. This can be related to reduced elasticity.

Additional Notes:

Results of measurements are critical to temperature changes. Accuracy of T_2 estimation is caused by the “good” volume of statistical averaging.

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