MONITORING OF THE PROCESSES IN WATER TREATMENT PLANT

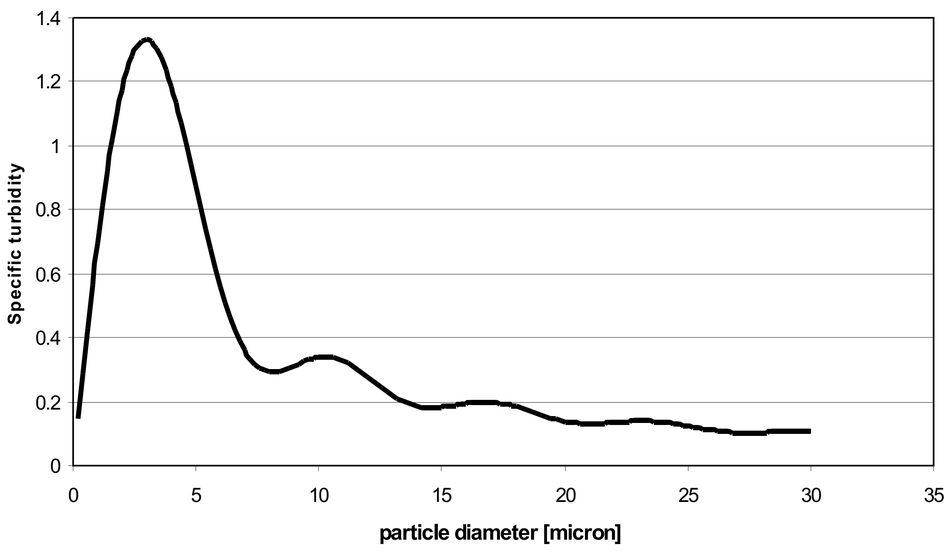
Michał Zielina

Cracow Unversity of Technology, ul. Warszawska 24, 31-155 Kraków, Poland
wdabrow@usk.pk.edu.pl tel. +48-12-628-2551

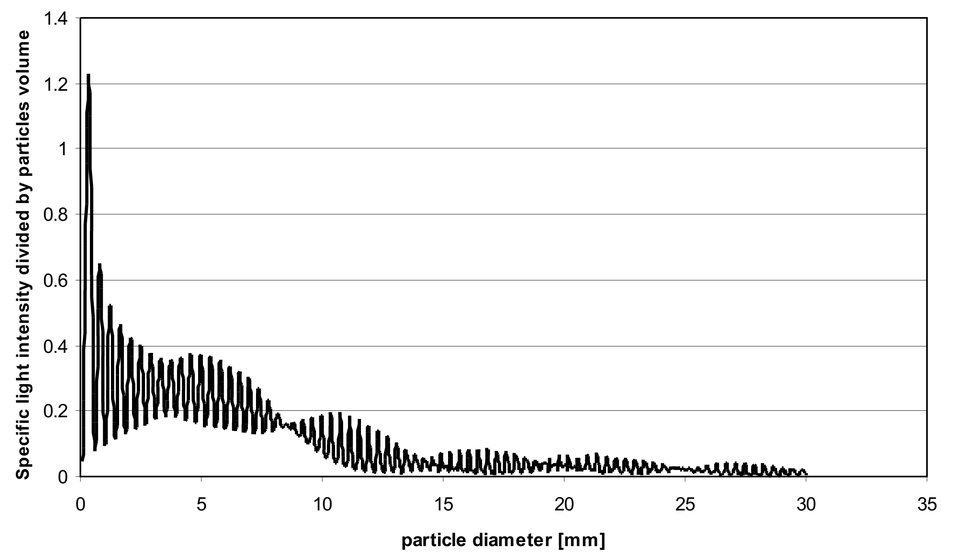
ABSTRACT

Traditionally, water treatment plant includes general processes like: coagulation, flocculation, sedimentation, filtration and disinfections. Optimal choice of working parameters for each of them is the most important designing principal. Unfortunately, all of the processes are very dynamic and strongly dependent on changing quality of raw water. In consequence, optimal working parameters guaranteeing relatively low cost and enough removal efficiency are also changing during the time. Complex mathematical descriptions indicate dependence of the processes on many parameters. Particle size distribution is one of the most important for all of them. Significant development of the particle size distribution (PSD) measuring methods was observed during last years. Simple and quick "on-line" PSD measurement is possible today. Particle size distribution enables more detailed water treatment processes analysis than still commonly used turbidity. The research was carried out in water treatment plant on Dłubnia river, which is one of the several supplying Krakow.

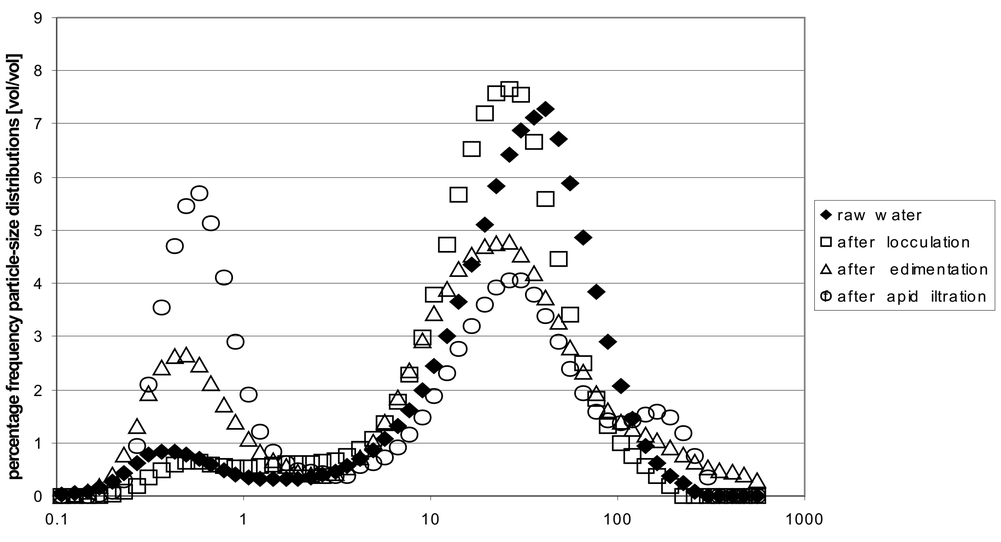
Flocculation, sedimentation and filtration were analyzed based on particle size distribution curves between processes. Refractive indexes were adequately selected. After flocculation, quantity of particles between 1 and 30 microns increased proportionally stronger than rest of the fractions. After sedimentation, particles bigger than 10 microns proportionally decreased, while particles smaller than one micron and bigger than 100 microns proportionally increased. During filtration process volume of particles bigger than one micron was removed proportionally better than rest of the particles from suspension. Total volumetric suspension concentration slightly increased after flocculation and visibly decreased after sedimentation and filtration. Interpretation of the particle size distribution measurements between unit water treatment processes was proposed in the paper.



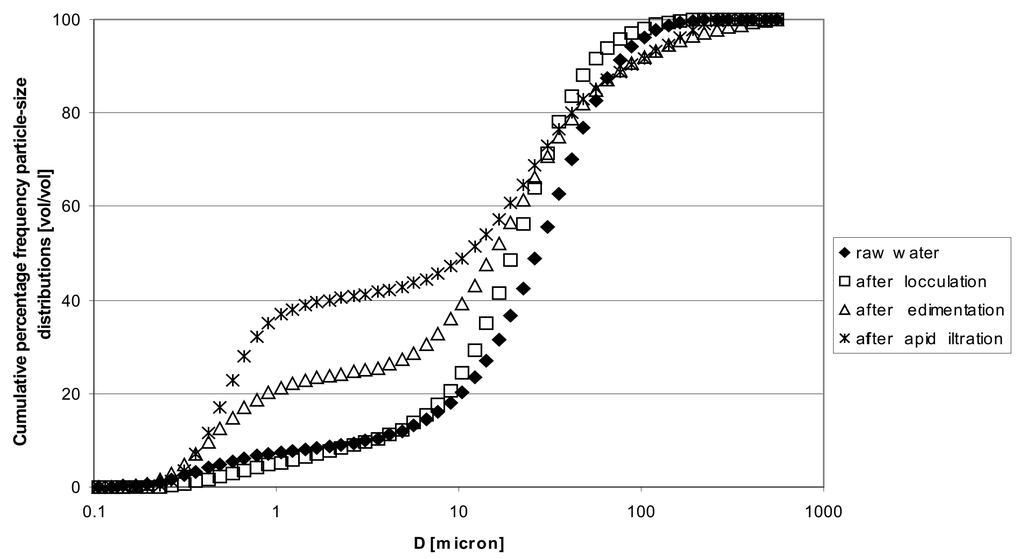
Specific turbidity (absorbance) defined as turbidity (absorbance) divided by volume of spherical particles versus particle diameter



Specific light intensity scattered at angle 90 degrees (nephelometric Measurement) divided by particle volume versus particle diameter



Percentage frequency particle-size distributions between unit treatment processes in Dlubnia water plant



Cumulative percentage frequency particle-size distributions between unit treatment processes in Dlubnia water plant

Unit process	Raw water, before coagulation	After slow mixing	After sedimentation	After rapid filtration
Turbidity[NTU]	42.4	47.6	1.46	0.35
Volumetric suspension concentration predicted by laser instrument [vol/vol]	0.000262	0.000394	0.000009	0.000002

Nephelometric turbidity and suspension concentration between each of the unit processes