New TU5 Series Process Turbidimeter For Raw Water Monitoring

A long-term evaluation of applicability of a TU5300sc turbidimeter equipped with Automated Cleaning Module (ACM) for raw water monitoring was conducted at a surface water treatment plant in Colorado. The plant alternates between two water sources – reservoir and river water, with each source presenting different challenges. The reservoir water usually has a lower turbidity (~1-2NTU), but undergoes seasonal inversion with rising manganese levels, which may cause the river water turbidity to vary wildly during summertime, when this source is used primarily.

Due to high fouling capacity of source water, the use of ACM with TU5 series turbidimeters is mandatory for raw water monitoring. The goal of this study was to verify the new turbidimeter performance against a reference analyser (a Hach® 1720D) that had been working in this application for many years. Main parameters of the evaluation included direct comparison of the readings (logged every 15 minutes), maintenance requirements, and ability of the ACM equipped with a fiber wiper to keep the measurement cell clean. The ACM was set to clean the cell every 7 days routinely and when threshold of 3.5 NTU was exceeded. The test lasted for over 100 days and its results are presented in both graphical and numerical formats below.

As seen in Figure 1 readings between two analysers trended well during the test on both reservoir and river water within a turbidity span of 0.4 to 30.4 NTU. The chart also shows the frequency of the ACM actions and readings of the TU5300sc's flow sensor. It is clearly seen that higher turbidities make it more challenging to maintain consistent sample flow. The sample flow to the TU5300sc was regulated using two regular ¼" ball valves.

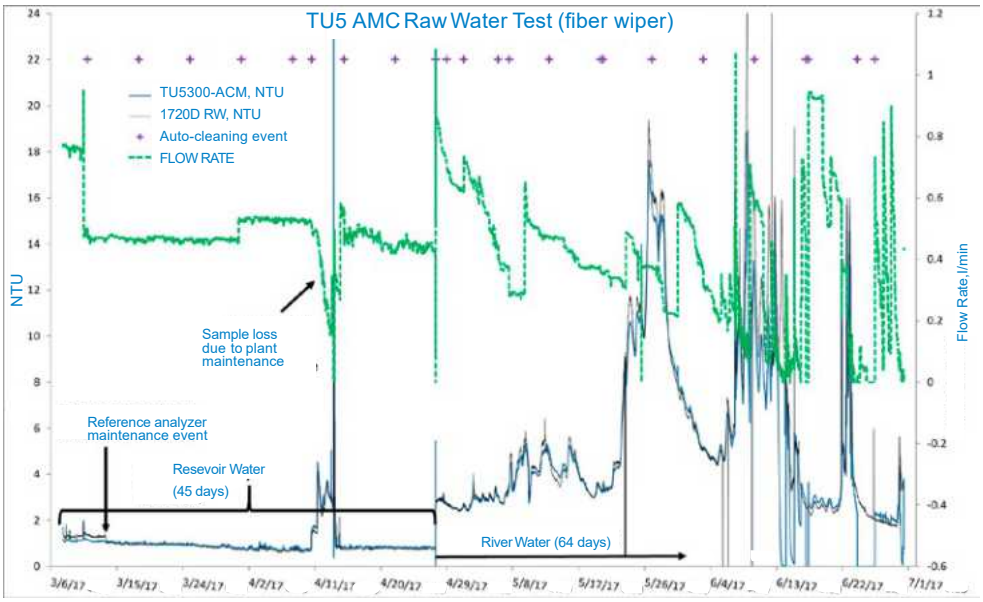


Figure 1 – Graphical representation of the test results.

Based on preliminary testing, the needle valve supplied with the turbidimeter for installation in the sample outlet to maintain positive pressure in the measurement cell was replaced with a regular ball valve. The installation specifics are presented in Figure 2.

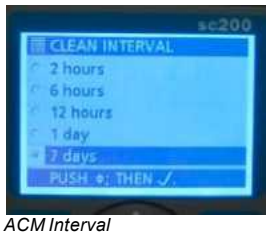
During the test, data was collected and analysed bi-weekly on average. The numerical test results in Table 1 confirms consistent performance of the TU5300sc when applied to challenging sample conditions. Additionally, the ACM with fiber wiper eliminated any need for manual intervention with the sample vial – it was clean after the test, see Figure 3.

The greatest difficulty was maintaining consistent sample flow during the river portion of the test – as may be seen from Figure 1, the flow needed to be restored every few days. While it may be considered a hassle, it takes only a few seconds to turn both ball valves off/on twice and then readjust the flow (displayed on the controller screen) to an acceptable value between 0.2 and 0.8 l/min by partially closing the outflow valve.

General TU5300 Setup

Intake Valve

Outlet Valve



ACM Interval

Reference instruments readout
(left – reservoir water, right – river water)

TU5300 readout
(resevoir water)

Figure 2 – main settings and representative comparison examples for the test

Figure 3 – photo of the vial after completion of 109 days of testing with fiber wiper. The vial looked completely clean after the test. Several additional vial checks were conducted during the test and the cleanliness was very consistent. In fact, the vial, which was installed on this instrument in October 2016, was working significantly longer in this application with ACM.

Table 1. Main test statistics, absolute and relative difference between the two instruments (target is 10% based on industry standards)*

Reservoir Water Test Results		River Water Test Results	
# of compared points = 4318	AVG ref. NTU = 0.944	# of compared points = 6061	AVG ref. NTU = 5.724
MIN reference NTU = 0.581	AVG diff. = 0.072 NTU	MIN reference NTU = 0.426	AVG diff. = 0.430 NTU
MAX reference NTU = 9.91	RSD = 7.7%	MAX reference NTU = 30.4	RSD = 7.5%

* A sum of the specified accuracy for each instrument is only applicable for measuring the same standard, not a real water sample.

Conclusion

The new TU5300sc analyser may be used for measuring raw water successfully, given the turbidity and other major parameters are within specified range and with several conditions:

- The ACM with fiber wiper is implemented.
- The supplied outlet needle valve is replaced with a standard ¼" (6 mm) ball valve (PN 5743700).
- The flow is closely monitored and restored as needed.

About the Author

Vadim B. Malkov (PhD Chemistry) joined Hach Company in 2002. Originally Dr. Malkov worked at Hach R&D and then moved over to the business organisation. During his tenure at Hach, he led and participated in development of several process analysers and applications. Vadim Malkov has published many papers in scientific and professional journals and presented results of his work at multiple conferences in the United States and abroad. Dr. Malkov is currently working at Hach as a Product Applications Manager for Process Solutions Business Unit focused on Drinking Water applications and specifically on disinfection processes and practices.

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