

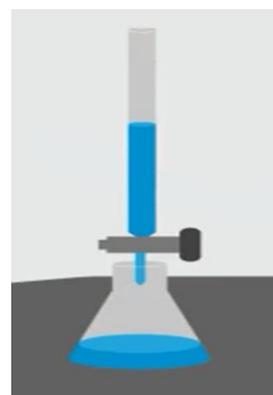
## *Top Five Reasons to Choose Automation in Titrators*

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For several decades, titration has been traditionally used as a core technology across multiple industries to determine unknown concentration of a solution within a sample. Manual titration has been the method of choice since the beginning of time and several institutions continue to use manual titration in their laboratories today. Visual inspection and manual addition of the reagent (also known as titrant) leads to subjective analysis and is entirely dependent on the chemist's or analyst's skillset. Additionally, this also requires the operator to invest time for manual calculations and determining end results of each titration.

Recent competition in the market has led to sectors raising bar for the quality of standards and to meet ongoing technology advancements. Industry users are looking for faster response times, repeatability, precision and accuracy, and GLP documents to be embedded within the SOP. The goal of automation in titration technology is to enable manufacturers and industry users to feel confident in their product quality ensuring results are independent of subjective bias.

*Auto titrator is a leading technology within the scientific community generating accurate and reproducible results.*



## *How does automatic titrator take care of the above crucial issues?*

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To gain deeper insights on this issue, let us first review the mechanism of action for titrators.

- ❖ A solution of a known strength (titrant) is added to a sample (analyte). The addition of the titrant continues until we see an endpoint. Once the endpoint is determined, the chemist can calculate the exact concentration of the analyte present in the sample. Most common titrations that take place are:
  - Acid-Base Titration (Aqueous or non-Aqueous)
  - Precipitation Titration
  - Complex metric using EDTA – Typical titration for hardness analysis.
  - Redox - Example DO analysis through Winkler technique

In an acid-base titration, one may observe a color change. In a precipitation titration, the chemist may be looking for a cloudy appearance (halides with silver nitrate). In order to assess a change in pH one uses an indicator solution such as phenolphthalein or methyl orange. The accuracy of such manual titration is entirely dependent on the chemist and is subjective on his or her perception. Moreover, this color change technique is unusable with colored samples.

## TOP FIVE BENEFITS OF USING AUTOMATIC TITRATION TECHNOLOGY

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Automation removes subjective bias.



- 1) Use of Sensor Technology: An automatic titrator uses electrode technology known for its accuracy and reproducibility. For instance, a pH electrode can be used for an acid-base titration, a silver electrode can be used for precipitation titration, a calcium electrode can be used for complex metric and a redox electrode can be used for ORP Titration.

All such electrodes are termed as an indicator electrode whilst being used in Titration technology. The main function of indicator electrodes is to observe major changes in “mv” values during titration. The end results are based on objective data rather than subjective perceptions of the chemist. This shall ensure that the sensor provides consistent results avoiding subjective-bias of the end-user.



- 2) Accuracy of Dispense Criteria: Other than the sensors in use, another crucial factor for accuracy is the consistency of the titrant being dispensed. In automatic titration, highly precise dispenser systems are utilized. The dispenser systems employ a piston driven burette that is controlled by the main unit. Modern automatic titrators dispense very low volumes of titrant, as low as one micro liter, which is next to impossible if titration is performed in a traditional, manual way. The dispenser can be preset to allow repeated dispensing based on the operator's requirements. Due to the micro-level dispensing volumes, the analysis can be completed in a precise manner driving significant improvements in the accuracy. Moreover, samples can be titrated in a reproducible manner since the machine dispenses with preset parameters. The operator can attain accurate results with fewer steps and significantly less room for error.



- 3 Reduce Chemicals and Sample size: To achieve accurate results, one must use smaller sample sizes. Automatic dispensers allow for minimal use of titrant with accuracy of one micro-liter that is highly unlikely in a manual titration technique.

From an environmental standpoint, disposal of chemicals is a critical issue. Regulatory bodies are strict with industries and are constantly pushing industries to limit hazardous disposal. Automation in titration supports this cause due to the limited consumption of titrant. This leads to reduced waste and expenses since there is a reduction in the amount of titrant that needs to be purchased.

*Note:* Reduction in titrant consumption does not compromise the accuracy of the analysis due to the highly precise dosing of the burette.

- 4 Time Efficient and Reduced Chemist Burden: Manual titration is extremely cumbersome and time consuming. Chemists are burdened with the task of continuously adding titrant while observing sample changes. The chemist is completely occupied throughout the process, including the manual calculations of the final results.

When titration is performed with an automatic titrator, the chemist does not have to be tasked with performing tedious procedures. They simply initiate the titration and can use their valuable time for other productive activities while the machine completes titration analysis. The machine stops automatically once the endpoint is achieved and will calculate the results accordingly. Automatic titration is an excellent return on investment for companies as it improves employee efficiency.

- 5 Traceability of Results: With automatic titrator, operators can get multiple data points on a single titration providing valuable details on every procedural step performed. Multiple data points allow for effective assessment of changes over the duration of a titration. In addition, multiple titrations can be performed to obtain RSD of analysis. This data can be stored in the instrument, on a USB or printed for record keeping.



## **CONCLUSION**

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Automatic titrators enhance precision, delivery accurate results, improve reproducibility and is an excellent return on investment for companies looking at improving resources efficiency.

### **What is our role?**

Thermo Fisher has been a pioneer in inventing sensor technologies for ages. Blending sensor technology with our proven titration system, we not only provide a leading titration system in the market but also offer after-market support and assist clients in developing and adjusting SOPs to act as wholistic partners. We are committed to providing ongoing support, including hands-on training and extending local support through our channel partners. If required, we also assist in method development based on existing SOPs of end-user ensuring their business needs are satisfied.



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