



# Customer Applications Guide

YSI BIOCHEMISTRY ANALYZER CAPABILITIES AND SOLUTIONS



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Thank you for your interest in YSI's Customer Applications Guide. Through the compilation of numerous end-user profiles, this guide provides a comprehensive overview of how YSI's biochemistry analyzers have helped many scientists with their unique applications and uses.

With over 40 years of providing rapid, accurate bio-analytical instruments, YSI Life Sciences has established a legacy of expertise in various industrial applications, including, but not limited to:

- Bioprocess monitoring and control
- Food & beverage processing and quality control
- Biofuel research and production
- Medical and sports physiology research

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My hope is that you will find this guide not only informative, but helpful and practical for your real-world analytical needs.

If you have an analytical application that you would like to share or have any questions, please let me know. Your input is highly valued.

*William Miller*

William Miller  
YSI Life Sciences, Product Manager

# The YSI Advantage

**What:** The YSI Life Sciences brand represents our series of Biochemistry Analyzers, which feature our innovative biosensor technology. Our analyzers provide critical measurement solutions for pharmaceutical, food & beverage, clinical, industrial and research applications. YSI Life Sciences analyzers measure a variety of parameters including sugars, alcohols, amino acids, organic acids, electrolytes and more.

**Who:** Our customers include pharmaceutical manufacturers, glucometer manufacturers, food processors, biofuel producers and medical researchers.

**Where:** Our biochemistry analyzers are used in quality assurance, research laboratories, manufacturing facilities and hospitals.

**Why:** Our analyzers are easy to use and cost effective. Our trusted measurement technology provides rapid, precise, interference free analysis for our customer's critical processes.



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Because the stakes are always high, our clients choose YSI Life Sciences because of our reputation as the Gold Standard in bio-analytical measurement, our quality products, and our dedication to customer support and service.

## Introduction

The following customer profiles represent the various industrial uses and applications of YSI Biochemistry Analyzers by YSI's United States customers. Many YSI customers were contacted to provide this information for you. We hope you will find this information useful in assisting you, the customer, for your particular application.

In many instances there are numerous customers with the same application. To avoid repetition, applications were only relisted when relatively insightful or different information was uncovered in any of the categories surveyed. For example, there were several customers using a YSI instrument for analyzing sucrose and dextrose in raw potatoes. If their previous methodology, disadvantages and/or benefits resulted in different or unique information, the application was listed again. By so doing, it is more likely that this document will provide more complete application information and better educate one to the spectrum of benefits attributed to using the YSI bio-analytical technology.

Lastly, the customer profile information will shed light on the disadvantages of alternative methodologies that may be encountered in the field.

We hope the information provided here proves useful to you.

# Features and Benefits Attributed by End-Users

The following list summarizes customer-provided feedback on the features and benefits of the YSI biochemistry analyzers:

- Confidence in the quality of the products
- Rapid results
- Reliable
- Reproducible results
- Economical cost per test
- Inexpensive to operate
- Minimal sample preparation
- Maintain great accuracy - essential for our application
- Quickly pays for itself
- Increases productivity
- High-throughput sample options, i.e., 96-well plate, are a tremendous time saver
- Results aren't operator-dependent
- Optimizes/maximizes production-increases profit
- Enables us to continually improve our process
- Offers 2 or more channels for simultaneous measurements
- Minimal interference sensitivities
- Accelerates research efforts; moves us more quickly to our research goals; decreases development time
- Simplifies our job
- Real-time measurements with rapid results allows us to make adjustments
- Enables us to pinpoint where in the process the problem has occurred
- Easily enables us to keep product within quality control specifications and creates great confidence in the quality of our products while ensuring customers are getting what they pay for
- Low maintenance, worry-free analyzer
- Much less reagent preparation
- Reagents are not toxic
- Saved us considerable money since we didn't have to purchase several HPLC's for remote plants
- Reagents need not be stored in the freezer
- Simple to use, easy to train on, user-friendly so you don't have to be a chemist to use
- Can use very small sample sizes
- Labor savings; results are obtained so much more quickly and easier than with other methods
- Saves time
- Automated measurements make it easy for students to use
- Saves money by decreasing wasted product
- Enhances the work we do
- Reliable over a wide range of glucose values
- Autocalibration reduces error
- Gives us results we would not be able to get otherwise
- Measures whole blood so it saves time by not having to spin down samples



## Bioprocess Customer Profiles

YSI's bioprocess market is comprised of the biopharmaceutical, biofuels and industrial biotechnology industries. Each customer profile listed provides a piece of the overall picture of the YSI's bioprocess market. Lab managers like that YSI analyzers are reliable, provide fast, accurate results, and require minimal operator training.

Several bioprocess applications herein are similar in that they are typically monitoring glucose, a common nutrient source for either mammalian, bacterial or fungal cell cultures. However, there are numerous other nutrients and metabolites that are important to various bioprocesses, and, in turn, require rapid, precise analysis. For example, YSI analyzers measure important nutrients, like glucose, sucrose and glutamine, and can monitor the level of potentially harmful byproducts, such as lactate and ammonium. Biopharmaceutical customers employ YSI's rapid electrode-based measurements to both monitor and control processes. In the biofuels sector, YSI analyzers measure xylose and glucose to monitor fermentation progress in cellulosic ethanol research and measure residual ethanol during distillation in production facilities.

In other applications, real-time monitoring of nutrients, metabolites and/or product is desirable or even essential. Through the use of YSI's online monitoring technologies, YSI analyzers are an invaluable tool for real-time analysis of critical nutrients, metabolites or products - regardless if the process duration spans a few hours or weeks.

1

**Company Product or Service:**

Biotech: enzyme used in cheese making/fermentation

**Analyte:** Glucose

**Previous Methodology:** YSI 2300

**Disadvantages of Previous Methodology:**

The YSI 2300 was designed for medical glucose measurements and does not offer the software flexibility

**Benefits of the YSI Product:** The YSI 2900 enables us to closely monitor the glucose levels in our fermentation production processes, thus optimizing enzyme production. The accuracy of the glucose measurements offered by the YSI is critical in the optimal production of this enzyme. Additionally, the ease of use of the YSI is a big advantage.

**Where is the YSI Used:** Production

2

**Company Product or Service:**

Biotech/pharmaceutical: oral medicines/fermentation

**Analyte:** Glucose and lactose

**Previous Methodology:** Technicon Autoanalyzer

**Disadvantages of Previous Methodology:**

Lactose wasn't a direct measurement on the Autoanalyzer. This measurement had to be calculated and this took extra time. Also, there was considerably more maintenance required with the Autoanalyzer due in part to the fact that there were a lot more parts on the Autoanalyzer than on the YSI. Finally, the reagent preparation was time-consuming.

Benefits of the YSI Product Maintenance on the YSI is much less of a concern and much less time-consuming and there is also much less reagent preparation. All of this simplifies our work and saves us time.

**Where is the YSI Used:** Production

3

**Company Product or Service:**

Biotech/pharmaceutical: anti-infective medicine/cell culture

**Analyte:** Glucose

**Previous Methodology:** Enzyme kit

**Disadvantages of Previous Methodology:**

Tool too long to get results back, nearly 30 minutes. The sample preparation required was too time consuming.

**Benefits of the YSI Product:** My job is to maximize cell growth in the fermentation and the YSI not only saves me time but it can be linked to a computer so you can do some type of automation. I am designing such an automated process now for my system. When this is complete, the YSI will prove to be a dramatic improvement over enzyme kits.

**Where is the YSI Used:** Process development

4

**Company Product or Service:**

Biotech/university based contract lab: cell cultures and fermentation

**Analyte:** Glucose and lactate

**Previous Methodology:** YSI 27

**Benefits of the YSI Product:** As a contract lab we run several hundred samples from one fermentation and we do about five fermentations simultaneously. The small cost per test is great because it is so low. The autosampler save a great deal of time over manual sampling of the Model 27. While the YSI is running samples we are busy doing other work. Also, we have a lot of student help and the YSI, since it so automated, cannot be broken by the students. This is a big benefit in our lab.

**Where is the YSI Used:** Process development

5

**Company Product or Service:**

Biotech/pharmaceutical: recombinant defective retro viruses used as a gene therapy approach for cancer treatment/mammalian cell culture

**Analyte:** Glucose and lactate

**Previous Methodology:** NA

**Benefits of the YSI Product:** The YSI is invaluable to us. It allows us to monitor the growth of the cells and to adjust feed rates on the bioreactor to keep the cells growing. Without the YSI, we would have no way of knowing what is going on in the culture.

**Where is the YSI Used:** Research and development

6

**Company Product or Service:**

Biotech/gene therapy: DNA coding for proteins to solve genetic defects/cell culture

**Analyte:** Glucose and lactate

**Previous Methodology:** NA

**Benefits of the YSI Product:** The YSI enhances our process development work because it enables us to perform our job in a more effective manner. It is very simple to use and it is a low maintenance item.

**Where is the YSI Used:** Process development

7

**Company Product or Service:**

Biotech: antibody/large-scale mammalian cell culture

**Analyte:** Glucose and lactate

**Previous Methodology:** An Abbott VP Clinical Chemistry Analyzer. This instrument was a 13-year old, outdated instrument with a very expensive component that needed replacing, so we were looking for an alternative methodology.

**Disadvantages of Previous Methodology:**

Outdated. Very expensive components and maintenance.

**Benefits of the YSI Product:** We monitor glucose and lactate in cell culture to maximize the protein production in our systems. The ultimate benefit is increased production of antibodies which equates to increased profits. The YSI is faster and more efficient to use than the previous method and the maintenance of the YSI is minimal in comparison.

**Where is the YSI Used:** Production

8

**Company Product or Service:**

Biotech/food manufacturer: monosodium glutamate (MSG)/fermentation

**Analyte:** Glutamate and glucose

**Previous Methodology:** Enzyme kit

**Disadvantages of Previous Methodology:**

Very slow and labor intensive. Enzymes had to be prepared for each sample. We usually did 12 samples at a time and this was a very tedious process.

**Benefits of the YSI Product:** The savings of time is significant. In addition to the YSI, we use the turntable. The speed of getting sample results and ease of use is wonderful. We simply make our dilutions, load the turntable and get busy doing other tasks. When we come back to the instrument we have our results! Less time is also spent on maintenance.

**Where is the YSI Used:** Process development

9

**Company Product or Service:**

Biotech/pharmaceutical: primarily therapeutic drugs/large-scale cell cultures

**Analyte:** Glucose and lactate

**Previous Methodology:**

Glucose strips; lactate wasn't analyzed

**Benefits of the YSI Product:** The YSI and turntable make our job much simpler than it used to be. We get fast measurement responses with high accuracy and reproducibility and the instrument is easy to maintain.

The YSI allows us to optimize the process, thereby optimizing the successful completion of each cell culture batch. The lactate measurement gives us one more piece of information to optimize the process. Additionally, the data we are constantly collecting gives us information to continue to develop and optimize the process itself.

**Where is the YSI Used:**

Pilot plant production/in-process work measurements



## 10

### Company Product or Service:

Biotech: vaccines

**Analyte:** Glucose, lactate and glutamate

### Previous Methodology:

HPLC used for lactate; Enzyme kit used for glucose; Glutamate wasn't analyzed

### Disadvantages of Previous Methodology:

HPLC was complicated and getting measurement results was a time-consuming proposition. Enzyme kits required a lot of inventory.

**Benefits of the YSI Product:** It is a definite time advantage to have a multi-parameter instrument that will do all of our critical measurements. Furthermore, the YSI is easy to learn to operate. We do not have the training issues associated with the need to learn a lot of different assays. The YSI also saves us space.

**Where is the YSI Used:** Process development and samples from manufacturing

## 11

### Company Product or Service:

Biotech/pharmaceutical: e-coli and yeast-based fermentation

**Analyte:** Glucose and lactate

### Previous Methodology:

Glucose dip sticks; Lactate not measured

### Disadvantages of Previous Methodology:

I had little to no interest in using dip sticks. They were not accurate enough.

**Benefits of the YSI Product:** The YSI is and will continue to be absolutely essential to the fermentation work we do. We cannot live without our YSI. We monitor glucose levels all the time and it enables us to control our fermentation just the way we like to.

### Where is the YSI Used:

Production and Research & Development

## 12

### Company Product or Service:

Biotech: vaccines for phase I clinical trials/e-coli, shigella, cholera, yeast fermentations

**Analyte:** Glucose

### Previous Methodology:

Glucose sticks. YSI Model 27.

### Disadvantages of Previous Methodology:

Glucose sticks were not accurate enough. The Model 27, everything had to be done manually allowing operator variances.

**Benefits of the YSI Product:** The current YSI model is invaluable in assisting with the tracking of critical glucose measurements. Glucose measurements enable us to stay one step ahead of the feed needs of the fermentation. With the YSI we can make the appropriate adjustments right when the fermentation is changing.

**Where is the YSI Used:** Research and production

## 13

### Company Product or Service:

Biotech/pharmaceutical: recombinant factor 8 and other products

**Analyte:** Glucose and lactate

### Previous Methodology:

YSI Model 2000

**Benefits of the YSI Product:** We can determine how healthy the fermentation cells are and if enough nutrients are being fed to the fermentation. Our glucose and lactate measurements are essential; they are very important metabolites, and by looking at them, we can determine the status of the fermentation. We have no way of knowing this status otherwise.

### Where is the YSI Used:

Process development and Research & Development

## 14

### Company Product or Service:

Biotech: supernatant from cell cultures

**Analyte:** Glucose and lactate

### Previous Methodology:

YSI Model 2000

**Benefits of the YSI Product:** We need our results stat and we have not found any other device that can give us results as quickly as the YSI and offers more than one channel simultaneously. We can just touch a button and literally walk away so we don't have to be there to get results.

**Where is the YSI Used:** Research & Development

## 15

### **Company Product or Service:**

Biotech/pharmaceutical: injectable drugs/fermentation

**Analyte:** Glucose

### **Previous Methodology:**

First enzyme kits then the Beckman Glucose Analyzer

### **Disadvantages of Previous Methodology:**

They required much more sample preparation, were less accurate and took longer to accomplish results.

**Benefits of the YSI Product:** The YSI is faster and much cheaper to operate. It is much more accurate and user-friendly and offers a wider range, too. It is an ideal instrument for measuring glucose in our fermentation broth. We also like the fact we don't have to store reagents in the freezer.

### **Where is the YSI Used:**

Process development and manufacturing

## 16

### **Company Product or Service:**

Biotech: veterinary vaccines/insect cell cultures

**Analyte:** Sucrose

**Benefits of the YSI Product:** With the YSI we are able to optimize production of cells in our bioreactors. Furthermore, we are developing a way to put the YSI on-line and automatically monitor and feed sucrose, the nutrient source, to the cell culture. This will further optimize the process and save numerous labor hours.

**Where is the YSI Used:** Product development

## 17

### **Company Product or Service:**

Biotech/pharmaceutical: recombinant bacterial fermentation

**Analyte:** Glucose

**Benefits of the YSI Product:** The YSI enables us to maintain a constant glucose concentration in our feed batch fermentation. This enables us to determine if glucose has an effect on the growth of the bacteria. Once we collect enough data we will be able to optimize our fermentation processes across the board.

**Where is the YSI Used:** Research

## 18

### **Company Product or Service:**

Biotech/renewable energy sources: biomass conversion to ethanol for automobile gasoline

**Analyte:** Glucose

### **Previous Methodology:** HPLC

### **Disadvantages of Previous Methodology:**

Cannot use the HPLC for rapid glucose measurements

**Benefits of the YSI Product:** With the YSI we can do rapid glucose measurements and get information immediately on our fermentation rather than having to send a sample to the lab. As a result, we can make any necessary changes immediately in our fermentation.

**Where is the YSI Used:** Research & Development

## 19

### **Company Product or Service:**

Biotech/veterinary pharmaceutical: antibiotics/fermentation

**Analyte:** Glucose

### **Previous Methodology:** YSI Model 2000

**Benefits of the YSI Product:** The current YSI model provides fast, reliable and accurate method for determining how well our raw materials are being used in the fermentation as well as an idea of the growth occurring in the fermentation.

**Where is the YSI Used:** Production

## 20

### **Company Product or Service:**

Biotech: proprietary enzyme for industrial applications

**Analyte:** Glucose, starch and lactate

### **Previous Methodology:**

YSI Model 27 and wet chemistry

### **Disadvantages of Previous Methodology:**

Both methods were too time consuming

**Benefits of the YSI Product:** The YSI autosampler provides real-time savings. It enables us to increase our productivity by decreasing our development time. We are able to reach our research goals in less time. I load the samples at night before I leave work and when I return I have the results. We love this system.

**Where is the YSI Used:** Research & Development

## Food & Beverage Customer Profiles

For over two decades YSI's Biochemistry Analyzers have been the analytical technology of choice for many major food and beverage manufacturers. The operations in which the YSI biosensor technology has been utilized spans from raw materials analysis through final product QC testing and effluent monitoring.

For example, many of our customers use their YSI analyzers for in-process testing to verify the quality of the product before it is packaged. Samples are typically pulled from production vessels and measured off-line. In the event of a problem, the product concentration, i.e., sucrose, can be adjusted before it is packaged. Customers note that in-process testing has resulted in substantial savings for their companies.



## 21

**Company Product or Service:** Wine producer

**Analyte:** Dextrose and lactate

**Previous Methodology:** Enzyme kit

**Disadvantages of Previous Methodology:**

Cost. Time consuming. Labor intensive.

**Benefits of the YSI Product:** The YSI is fast, accurate and inexpensive to operate. The investment in the YSI will pay for itself in about 2 years. It is used with the turntable. The YSI is indispensable to our quality control efforts.

**Where is the YSI Used:** Production

## 22

**Company Product or Service:**

Monosodium glutamate manufacturer

**Analyte:** Glutamate and dextrose

**Previous Methodology:**

Enzyme kit and sometimes an HPLC

**Disadvantages of Previous Methodology:**

Costly, time-consuming and labor-intensive

**Benefits of the YSI Product:** The YSI is fast and easy to operate. It allows us to work on other things. We spend less time on maintenance too.

**Where is the YSI Used:**

Production and process development

## 23

**Company Product or Service:**

Sugar-free ice cream and sugar-free soft drinks

**Analyte:** Sucrose and glucose

**Benefits of the YSI Product:** We are required to make sure our sugar-free products are truly sugar-free as advertised. We appreciate how easy the YSI is to use and how quickly it provides measurement results.

**Where is the YSI Used:**

Manufacturing, in-process, and final product testing

## 24

**Company Product or Service:**

Specialty grains/oat processing facility: new breakfast cereal

**Analyte:** Sucrose; the coating used on the oats

**Benefits of the YSI Product:** We just started using it but can see it will prove to be a good investment. Once we establish it for large volume runs it will easily pay for itself. The quick turnaround time of results enables us to quickly identify problems in process and make the necessary adjustments almost immediately.

**Where is the YSI Used:** Manufacturing

## 25

**Company Product or Service:**

Cereal and breakfast food manufacturer

**Analyte:** Glucose

**Previous Methodology:** HPLC

**Disadvantages of Previous Methodology:**

Salt interference from our high-salt food samples.

**Benefits of the YSI Product:** Interferences are not an issue on our YSI. We would have no other way of analyzing glucose in our high-salt food samples if it were not for the YSI.

**Where is the YSI Used:** Manufacturing

## 26

**Company Product or Service:**

Potatoes: largest US potato chip industry supplier

**Analyte:** Dextrose and sucrose

**Previous Methodology:**

We sent samples off to a lab at \$25 per sample

**Disadvantages of Previous Methodology:**

Expensive and we did minimal sampling due to sample costs

**Benefits of the YSI Product:** The YSI saves us between \$50-\$55K yearly! With the YSI we can determine when the potatoes will go off color and most people prefer light colored chips. This allows us to save thousands of dollars in lost product.

**Where is the YSI Used:** Raw material testing

## 27

### **Company Product or Service:**

French fries: monitors the maturity of potatoes in storage and monitors the broth in which the potatoes are fried

**Analyte:** Sucrose and dextrose in raw material and dextrose in fry broth

**Benefits of the YSI Product:** Money is saved in both raw materials and in finished product and we are assured that our product is consistently high quality.

### **Where is the YSI Used:**

Raw material and in-process testing

## 28

### **Company Product or Service:**

Cheese: chief supplier to McDonald's

**Analyte:** Lactose

**Previous Methodology:** YSI Model 27

**Benefits of the YSI Product:** Measures the lactose in cheese filtrate. Lactose is a filler in cheese and there are regulations on how much filler can be used. The current YSI model insures that we do not have to compete with a competitor that is producing a product that is not only less expensive to make but to sell as well.

**Where is the YSI Used:** Research

## 29

### **Company Product or Service:**

Cereal products: granola cereal and granola bars, graham cracker crusts and fruit bars

**Analyte:** Dextrose and sucrose sprayed on the products

**Previous Methodology:** Lane Eynon Titration

### **Disadvantages of Previous Methodology:**

It took 45 minutes to get a sample which we could only use for reporting since it took so long. It also required toxic chemicals and there was a lot of waste. Very costly. Not very accurate depending on the technician using it.

**Benefits of the YSI Product:** With the speedy results it's possible we can use it for in-process control. We don't have wasted product which saves a lot of money. The biggest savings has been in labor and time. Results aren't operator-dependent so we have consistent, accurate results with no toxic chemicals.

### **Where is the YSI Used:**

In-process quality control and Research & Development

## 30

### **Company Product or Service:** Cereal

**Analyte:** Dextrose and sucrose

### **Previous Methodology:**

Brix measurement on a refractometer

### **Disadvantages of Previous Methodology:**

We wanted to look at sucrose and not a total sugar measurement. The refractometer is subject to a lot of interferences.

**Benefits of the YSI Product:** With the YSI we're able to specifically look at sucrose and we can do dextrose if necessary. This easily enables us to keep coating on our cereal in spec. Also, now we can take any product and not have to worry about the sample matrix, since the YSI does not have interference sensitivities as did the refractometer.

### **Where is the YSI Used:**

In-process, final product and raw material testing

## 31

### **Company Product or Service:**

Snack foods

**Analyte:** Dextrose and sucrose; lactose for cheese flavored seasoning

### **Previous Methodology:**

Mohr Titration for dextrose and sucrose; Not monitoring lactose

### **Disadvantages of Previous Methodology:**

No way of truly determining what or where the problem was. We would have to throw away a lot of product unnecessarily.

### **Benefits of the YSI Product:**

The YSI helps us immeasurably. Now we have increased confidence in the accuracy of our sample results and there is a lot more product quality consistency.

We are able to go back and resample if we get products that are out of specs, and we can track where our problem started and eliminate material not fit for the market. We don't have a dollar amount but we've been able to save a lot of product that previously may have been thrown out.

### **Where is the YSI Used:**

In-process and final product testing

## 32

**Company Product or Service:** Candy

**Analyte:** Dextrose, sucrose and lactose

**Previous Methodology:** Used an outside lab

**Disadvantages of Previous Methodology:**

Expensive - \$75 per test. This high cost per test limited the number of tests that were done even though we would have preferred to run more.

**Benefits of the YSI Product:** The YSI gives us fast response time, good reproducibility and repeatability. Sample preparation is easy. Very low maintenance. Our payback time has been very short, 4-6 months.

**Where is the YSI Used:** Final product testing

## 33

**Company Product or Service:** Broth and food bases

**Analyte:** Glutamate

**Previous Methodology:** YSI Model 27.

**Benefits of the YSI Product:** Immediately the newer YSI model gave us the utmost confidence that we are meeting our required specifications. With MSG being a controversial ingredient, it is critical for us to know that we aren't over-seasoning with MSG.

**Where is the YSI Used:** Final test

## 34

**Company Product or Service:** Pet food

**Analyte:** Dextrose and starch (% cook)

**Previous Methodology:** YSI Model 2000

**Benefits of the YSI Product:** It is critical for the YSI to do speedy measurements as we often have trucks waiting at the door to be loaded with pet food. With the YSI no risks exist for a batch of feed being shipped that is not within % cook specifications.

**Where is the YSI Used:** Final test

## 35

**Company Product or Service:** Pet food: % cook

**Analyte:** Dextrose and starch (% cook)

**Previous Methodology:**

Outside lab at a cost of \$45 per test

**Disadvantages of Previous Methodology:**

Expensive and time-consuming. Up to 3 weeks sometimes.

**Benefits of the YSI Product:** With the YSI we don't need to worry about quality issues with our product. We are confident that any bad product is caught in a timely manner before shipment for distribution. We know our customers will always get the quality product they deserve and pay for.

**Where is the YSI Used:** In-process and final test

## 36

**Company Product or Service:** Dry bakery mixes

**Analyte:** Sucrose and dextrose

**Previous Methodology:**

We had to send our samples across the country to a sister company's lab.

**Disadvantages of Previous Methodology:**

Very time-consuming. Once we got the results they were relatively meaningless since so much time elapsed.

**Benefits of the YSI Product:** We get immediate results and can quickly identify problems and correct them if needed. This has saved us time and money in less wasted product as well. The YSI is simple to operate and easy to learn to use. It has helped us improve our process too.

**Where is the YSI Used:**

Production and Research & Development

## 37

### **Company Product or Service:**

Alcohol beverage production

**Analyte:** Glucose

**Previous Methodology:** HPLC

### **Disadvantages of Previous Methodology:**

In some of our plants the cost of HPLC is prohibitive.

**Benefits of the YSI Product:** The YSI has enabled us to significantly reduce capital expenditures while maintaining the necessary analytical measurements. Much easier to use and significantly simplifies the analytical measurement demands. Also, a non-technical person can essentially operate the YSI.

### **Where is the YSI Used:**

Raw materials and in-process testing

## 38

**Company Product or Service:** Candy

**Analyte:** Dextrose

**Previous Methodology:** YSI Model 27

### **Disadvantages of Previous Methodology:**

More difficult to train and use

**Benefits of the YSI Product:** The newer YSI is tied into our in-house quality control database. This represents a tremendous time-savings. Much simpler to use. There has been a terrific reduction in human error provided by the automation of the YSI. There is improved accuracy, and the time savings offered by the autocalibration feature has been significant.

### **Where is the YSI Used:**

Raw materials and in-process testing

## 39

### **Company Product or Service:**

Manufactures choline chloride for animal feeds

**Analyte:** Choline

**Previous Methodology:** Titration

### **Disadvantages of Previous Methodology:**

Hazardous materials used in titration. Impurities interfere with an accurate reading. Titration is slower and less accurate and not as easy to use.

**Benefits of the YSI Product:** The YSI gives us reliable measurement that is scientifically verifiable. This significantly increases the confidence our customers have in the product and gives us security knowing the quality of our product.

### **Where is the YSI Used:**

Research & Development, in-process quality control, and final product quality control

## 40

### **Company Product or Service:**

Dairy: manufactures a low-lactose milk for lactose-intolerant people

**Analyte:** Lactose

**Previous Methodology:** YSI Model 27

**Benefits of the YSI Product:** The automation of the newer YSI saves us a lot of time and decreases the amount of technician training needed. The quick process corrections we can make as a result of the rapid sample results obtained enables us to realize a cost savings in product too.

### **Where is the YSI Used:**

In-process and finished product testing

## 41

### **Company Product or Service:**

Grain processing company: manufactures methylglucoside, an ingredient in insulation

**Analyte:** Glucose

**Previous Methodology:** HPLC

### **Disadvantages of Previous Methodology:**

Interferences. Had to replace a high-cost guard column every two weeks.

**Benefits of the YSI Product:** We can get results we couldn't get otherwise and the results are rapid. The cost per test is much cheaper.

**Where is the YSI Used:** In the final product testing

## 42

### **Company Product or Service:**

Tomato paste and spaghetti sauce manufacturer

**Analyte:** Lactate

**Previous Methodology:** Enzyme kit

**Benefits of the YSI Product:** We wanted to measure L-Lactate and the advantage doing it with the YSI is significant. The YSI is used as a preventative measure to catch the lactic acid problem before we have a batch of product that has to be put on hold. We can use a technician to run the YSI instead of a chemist.

### **Where is the YSI Used:**

In -process and finished product testing

## Medical Research Customer Profiles

Some customers use their YSI instrument for point-of-care (POC) in-vitro medical diagnostics for blood sugar monitoring or verify the quality of their hand-held glucose meters during manufacture. This application has helped further establish YSI as a standard in the clinical and diabetes research markets.

Medical and other research applications include:

- STAT Lab or Central Lab POC
- Diabetes Evaluation
- Diabetes / Endocrinology Research
- Cancer Cell Metabolism Studies
- Stem Cell Therapy Research/Development
- Handheld Monitor Development
- Human Performance Evaluation
- Exercise / Athlete Evaluation
- Cardiac / Pulmonary Rehabilitation
- Neonatology / Pediatrics
- General Metabolic Research
- Veterinary Medicine & Research
- Pharmaceutical Quality Assurance



## 43

### **Company Product or Service:**

Medical research/university based: non-invasive liver metabolism research

**Analyte:** Glucose and ethanol

**Previous Methodology:** Enzyme kit

### **Disadvantages of Previous Methodology:**

Too time-consuming and cost prohibitive

**Benefits of the YSI Product:** Easy to use. Compared to previous methodologies, the YSI simplifies our research. It is reliable over a wide range of glucose values. We especially appreciate its ability to read our lower glucose samples that are 20-fold lower than prevailing blood glucose. With these low range samples we do not have to make adjustments in the analyzer or use large volume samples in order for the results to be reproducible.

**Where is the YSI Used:** Research

## 44

### **Company Product or Service:**

Medical research/university based: we monitor stress hormones in human blood to determine their relationship to several illnesses

**Analyte:** Glucose and lactate

**Previous Methodology:** YSI Model 27

### **Disadvantages of Previous Methodology:**

Couldn't use an autosampler. Manually handling all the samples was time consuming.

**Benefits of the YSI Product:** We can work more efficiently. We use it exclusively and it saves us a great deal of time. The cost per test is very economical and the analyzer is efficient. I never have a problem with it. It just keeps on running and the required maintenance is minimal.

**Where is the YSI Used:** Research

## 45

### **Company Product or Service:**

Medical research/university based: cardiac physiology research

**Analyte:** Glucose and lactate

**Previous Methodology:** Enzyme kit

### **Disadvantages of Previous Methodology:**

Too time-consuming and expensive

### **Benefits of the YSI Product:**

The ease of use of the YSI and rapid sample results dramatically increases research productivity. Results are very reproducible.

**Where is the YSI Used:** Research

## 46

### **Company Product or Service:**

Pharmaceutical company doing research

**Analyte:** Glucose

### **Previous Methodology:**

Ray Chem kit used with a spectrophotometer

### **Disadvantages of Previous Methodology:**

Very time-consuming and labor intensive; a typical experiment requires 3 hours of analysis time. Factoring in the labor cost, the cost per test is very high. Finally, this method is more prone to errors due to pipetting and the maintenance on our spectrophotometer was high.

**Benefits of the YSI Product:** Very reliable, reproducible and trouble free from a maintenance perspective. The automation eliminates the variabilities we experienced in our previous methodology. In the long run there will be a considerable cost savings realized.

**Where is the YSI Used:** Research

## 47

### **Company Product or Service:**

Pharmaceutical company: metabolic research specifically on type II diabetes

**Analyte:** Blood glucose and plasma glucose

**Previous Methodology:** YSI Model 27

**Benefits of the YSI Product:** The accuracy, dependability and reliability of the YSI enable us to have the utmost confidence in our research results. Furthermore, it provides us with the opportunity to customize our research with continuous monitoring giving us a research edge.

**Where is the YSI Used:** Research

## 48

### **Company Product or Service:**

Pharmaceutical company: metabolic disease and diabetes research

**Analyte:** Glucose and lactate

**Previous Methodology:** YSI 2700

**Benefits of the YSI Product:** The YSI is ideal for us. It is critical to our research to have an analyzer that offers stability, reliability and accuracy on small sample sizes as does the YSI.

**Where is the YSI Used:** Research

49

**Company Product or Service:**

Medical research/university based: research changes in metabolism in space

**Analyte:** Lactate

**Previous Methodology:** No lactate measurements

**Benefits of the YSI Product:** We really depend on the fast accurate results the YSI provides. The confidence we find in the results is high. This confidence is invaluable to the success of our research.

Furthermore, the YSI is easy to use and maintain.

We don't have to deal with toxic chemicals and anyone can be trained to operate the YSI. It is a great addition to our lab.

**Where is the YSI Used:** Research

50

**Company Product or Service:**

Medical research/hospital based

**Analyte:** Glucose and lactate

**Previous Methodology:** Apec Glucose Analyzer

**Disadvantages of Previous Methodology:** NA

**Benefits of the YSI Product:** Five distinct advantages of the YSI:

- Much more accurate

- Speed of results

- Saves considerable time

- Reliable

- Able to use very small sample size

**Where is the YSI Used:** Research

51

**Company Product or Service:**

Medical research/university based: liver research

**Analyte:** Galactose

**Previous Methodology:** YSI Model 27

**Benefits of the YSI Product:** Saves a lot of time and is a lot easier to use

**Where is the YSI Used:** Research

52

**Company Product or Service:**

Medical research/hospital: liver research

**Analyte:** Galactose

**Previous Methodology:**

YSI Model 27 and Technicon AA2

**Disadvantages of Previous Methodology:**

Manual handling of samples was time-consuming. Interferences.

**Benefits of the YSI Product:** Automation features saves us a lot of time and is a lot easier to use.

The time savings of us doing 80 samples per day has been fantastic! The reproducibility is marvelous.

It gives remarkably good data. The surgeons really rely on the numbers and the numbers have true meaning for the surgeons on liver function.

**Where is the YSI Used:** Research

53

**Company Product or Service:**

Medical research/university based

**Analyte:** Hydrogen peroxide

**Previous Methodology:** NA

**Benefits of the YSI Product:** Able to conduct research since the YSI is able to read very small sample sizes.

It also is sensitive enough for us to carry out our research. The YSI is a lot more efficient and much less time-consuming than the alternative technology we were considering.

**Where is the YSI Used:** Research

**Other** Customer Profiles



54

**Company Product or Service:**

Glucometers for home use in the diabetic market

**Analyte:** Glucose

**Previous Methodology:** YSI Model 2700

**Benefits of the YSI Product:** We can count on the YSI as a gold standard for our glucometers. They are very easy to use and maintain. Its reliability, accuracy and reproducibility gives us confidence that our customers will be satisfied with our product when they get it home.

**Where is the YSI Used:**

Production and Research & Development

55

**Company Product or Service:**

Industrial research

**Analyte:** Hydrogen peroxide

**Previous Methodology:** Iodometric titration

**Disadvantages of Previous Methodology:**

Wasn't accurate enough and wasn't a broad enough range. Toxic chemicals were required and each sample took 5-10 minutes. It was a very tedious task.

**Benefits of the YSI Product:** Our research was significantly enhanced with the use of the YSI. Its broad range and fast response time proved invaluable in our research. The fast response time enables us to do lots of samples thereby allowing us to closely track the process.

**Where is the YSI Used:** Research

56

**Company Product or Service:** Tobacco

**Analyte:** Glucose

**Previous Methodology:** HPLC

**Disadvantages of Previous Methodology:**

Expensive to maintain and it required a highly skilled operator. Sample preparation was very time-consuming.

**Benefits of the YSI Product:** Sample prep is minimal and sample results are speedy. We could train a less skilled operator. For these reasons the YSI was a good choice for our plants located in remote areas, we are assured product quality is high.

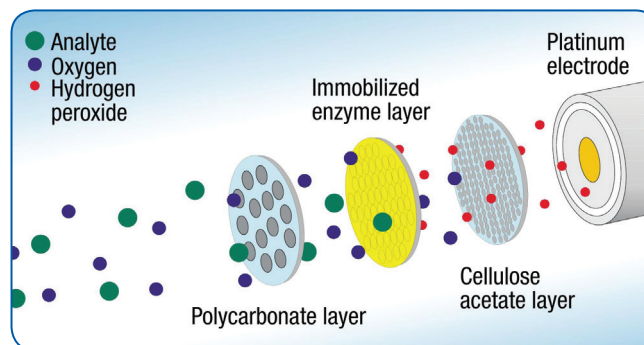
**Where is the YSI Used:** In-process quality control.

# The YSI Biosensor Technology

YSI's innovative enzyme electrode technology harnesses the power of enzymatic specificity and catalysis to provide a rapid, precise analytical tool. Enzymes, which are powerful biological catalysts, can accelerate reactions by factors of at least one million<sup>2</sup>. Additionally, enzymes are highly specific for both the reaction catalyzed as well as its choice of substrate<sup>2</sup>. YSI immobilizes substrate-specific enzymes between two selective, interfering membranes and couples the membrane component to a platinum electrode, which results in a highly specific measurement for a given substrate.

To better explain how the enzyme electrode technology works, an example of a common food ingredient analysis, i.e., dextrose (D-glucose), will be used. An enzyme probe is fitted with a three-layer membrane containing immobilized glucose oxidase enzyme in the middle layer. The face of the probe, covered by the membrane, is situated in a buffer-filled sample module into which the dextrose sample is injected by the instrument. The dextrose diffuses through the first membrane. When it contacts the immobilized glucose oxidase, it is rapidly oxidized, producing hydrogen peroxide ( $H_2O_2$ ).

$H_2O_2$ , in turn, passes through the inner membrane and is oxidized at the platinum anode, producing electrons. A dynamic equilibrium is achieved when the rate of  $H_2O_2$  production and the rate at which  $H_2O_2$  leaves the immobilized enzyme layer are constant and is indicated by a steady state response. The electron flow is linearly proportional to the steady state  $H_2O_2$  concentration and, therefore, to the concentration of the substrate. All of this occurs in a matter of seconds, which results in a sample analysis cycle of 60 seconds or less per chemistry analyzed (Figure 1).



**Figure 1**  
YSI Enzyme Electrode Technology. Enzyme specificity and proprietary membrane attributes allow for rapid, precise and essentially interference-free analysis.



**Figure 2**  
The YSI 2950 Biochemistry Analyzer can simultaneously measure up to six chemistries for raw materials, R&D, in-process and final product sample analysis.

Sample analysis requires little or no preparation due to the YSI Biochemistry Analyzer's unique sample chamber design and membrane characteristics, which makes the enzyme electrode impervious to sample color, pH, turbidity, cell concentrations, salts, proteins, detergents and other low molecular weight interferences. Additionally, only small sample volumes are needed, ranging between 10-50  $\mu\text{l}$ . The YSI 2900 Series Biochemistry Analyzers are highly flexible, modular platforms with a range of configurations, options and accessories to meet the various needs of the food process cycle, regardless of scale of operations (Figure 2).

Up to six different chemistries can be measured simultaneously using automated, high-throughput options, i.e., 96-well plates, stat mode for immediate process sample checks and automated on-line sample analysis for the food and beverage process and effluent streams. Each analyzer offers an intuitive graphic user interface, onboard training videos and multiple data management options. As compared to other conventional methods, such as HPLC, YSI Biochemistry Analyzers offer a low-cost alternative for both initial capital investment and cost per chemistry test (\$0.10 - \$0.70 USD/sample). Other features include low maintenance requirements and easy product changeover.

# YSI Life Sciences Media



A wide range of application notes is available online for download [ysi.com/lifesciences](http://ysi.com/lifesciences)



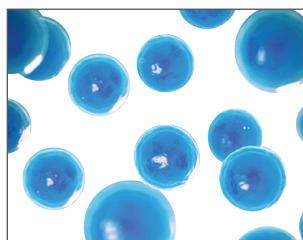
## Bioprocess Monitoring

Bioreactor glucose and lactate. YSI analyzers are an essential part of many stages of bioprocessing, including: R&D, process optimization, scale-up and production. Our analyzers provide critical off-line and on-line process analysis for biopharmaceutical, biofuel, and other industrial biotechnology manufacturing processes.



## Food and Beverage

For years, food technologists have trusted YSI Biochemistry Analyzers for ensuring food and beverage product quality through rapid, precise analysis of carbohydrates, alcohols, amino acids, and electrolytes.



## Medical Research and Sports Physiology

From diabetes and cancer research to stem cell therapy and sports physiology applications, YSI's gold standard biosensor technology is recognized as the scientist's analytical technology of choice.

 [youtube.com/user/ysilifesciences](https://youtube.com/user/ysilifesciences)



**Life Sciences**  
Data for Life.™

a **xylem** brand

YSI Life Sciences develops and manufactures scientific instruments, sensors and systems that serve a variety of scientific and industrial markets worldwide. YSI has a long history in the life sciences and bioanalytical markets, most notably with our introduction of the world's first commercial whole blood glucose analyzer in 1975. Today there are over 10,000 YSI instruments installed around the world, trusted in critical situations to provide the most accurate data in the shortest time.

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