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What is claimed is: A method for operating an automated clinical sample workcell having a sample conveyor connecting two or more analyzers and at least one centrifuge operated by a first centrifuging protocol to a sample input station by: The method of claim 1 further comprising: The method of claim 2 wherein the first centrifuging protocol is for samples to be processed in a chemical analyzer. The method of claim 2 wherein the second centrifuging protocol is for samples to be processed in a coagulation analyzer. The method of claim 2 wherein the first and second centrifuging protocols are identical, the method comprising: The method of claim 1 further comprising operating the conveyor to deliver the sample to the analyzer adapted to perform the tests to be performed 7. A method for operating an automated clinical sample workcell having a sample conveyor connecting two or more analyzers and two or more centrifuges operated by a first centrifuging protocol to a sample input station by: A method for operating an automated clinical sample workcell having a sample conveyor connecting two or more analyzers, a first centrifuge operated by a first centrifuging protocol and a second centrifuge operated by a second protocol to a sample input station by: An automated clinical sample workcell comprising: The method of claim 1 wherein the centrifuging requirements are requirements for samples based on the sample fluid being processed. The method of claim 1 wherein the centrifuging requirements are requirements for samples based on the assay to be performed on said sample. The method of claim 1 wherein the centrifuging requirements are for samples to be processed in an analyzer not connected to the workcell. The method of claim 1 wherein the centrifuging requirements are for samples to be processed in a user defined analyzer. More particularly, the present invention relates to a method for managing the different processes involved in pre-assay treatment of samples that require differential centrifuging prior to analysis by such analyzers within such an automated clinical sample handling workcell BACKGROUND OF THE INVENTION A wide variety of automated chemical analyzers are known in the art and are continually being improved to increase analytical menu and throughput, reduce turnaround time, and decrease requisite sample volumes. Such improvements, while useful in themselves, may be hampered if sufficient corresponding advances are not made in the areas of pre-analytical sample preparation and handling. Sample preparation and handling includes sorting, batch preparation, centrifugation of sample tubes to separate sample constituents, cap removal to facilitate fluid access, and the like. Automated sample preparation systems are commercially available and these generally include the use of conveyor systems for conveying specimens to clinical analyzers, such as those described in U. A disadvantage of many of these conveyor systems is that they are an integrated and dedicated part of a total integrated system, which system includes special analyzers and other handling equipment. More universal sample handling systems have more recently been introduced, like that described in U. For purposes of certain laboratory clinical chemistry tests, plasma, obtained from whole blood by centrifugation, is most often used in the analysis. To prevent clotting, an anticoagulant such as citrate or heparin is added to the blood specimen immediately after it is obtained or the anticoagulant is present in the evacuated blood collection tube when the patient sample is originally obtained. The specimen is then centrifuged to separate plasma from blood cells. For many biochemical laboratory tests, plasma and blood serum can be used interchangeably. Serum resembles plasma in composition but lacks the coagulation factors. It is obtained by letting a blood specimen clot prior to centrifugation. For this purpose, a serum-separating tube may be used which contains an inert catalyst such as glass beads or powder to facilitate clotting as well as a portion of gel with a density designed to sit between the liquid and cellular layers in the tube after centrifugation, making separation more convenient. Tests of coagulation require all clotting factors to be preserved. Serum, therefore, is inappropriate for these tests. A citrated evacuated blood collection tube is usually used, as the anticoagulant effects of citrate is dependent upon concentration and can be reversed for testing. In addition, serum is preferred for many tests as the anticoagulants in plasma can sometimes interfere with certain analytical results. Different anticoagulants interfere with different tests; using serum means the same sample can be used for many tests. In protein electrophoresis, using plasma causes an additional band to

be seen, which might be mistaken for a paraprotein. Clinical chemistry diagnostic analyzers associated with such sample preparation systems are adapted to automatically perform chemical assays and immunoassays on biological samples such as urine, blood serum, plasma, cerebrospinal liquids and the like, these samples generally being contained in capped sample tubes. From these signals the concentration of the analyte in the sample may be calculated. Another type of sample analysis, coagulation tests, is used to diagnosis hemorrhagic conditions such as hemophilia, where one or more of the twelve blood clotting factors may be defective. Popular laboratory coagulation tests typically employ turbidimetric or other measuring techniques. For most coagulation tests, whole-blood samples are collected into a citrate vacutainer and then centrifuged to obtain a plasma sample. The assay is performed with plasma to which a sufficient excess of calcium has been added to neutralize the effect of citrate. The PT reported as time in seconds, represents how long a plasma sample takes to clot after a mixture of thromboplastin and calcium are added. The aPTT measures the clotting time of plasma, from the activation of factor XII by a reagent a negatively charged activator such as silica and a phospholipid through the formation of a fibrin clot. Activated clotting time ACT is test that is used to monitor the effectiveness of high dose heparin therapy. ACT tests however use undiluted blood from sites which have not been contaminated by heparin infusion. The whole blood sample is transferred to appropriate test vial, mixed with the activator and a timer activated on an ACT analyzer. The overall analytical throughput of a laboratory may be increased by linking together analyzers of different types, each adapted to perform a certain menu of assays within a single workcell. However, a problem arises when both clinical chemistry and coagulation analyzes are linked to the same workcell because different centrifuging processes may be required to produce different properly separated samples for the different types of tests. From the above discussion it is evident that analytical tests may be performed on whole blood, plasma or serum, and that sometimes either plasma or serum may be used. Thus, different centrifugation processes may be required for different samples depending upon what tests are to be performed by which analyzers. Thus, while automated systems have advanced sample handling and processing throughput, what has not been addressed is the difficulty associated with handling samples that require differential centrifuging, different centrifuge protocols, within automated clinical sample handling workcells. SUMMARY OF THE INVENTION The present invention provides for detecting and classifying patient samples at the input station of an automated clinical sample handling workcell with two or more independent coagulation and clinical chemistry analyzers prior to analysis and enabling only those samples that have pre-analysis centrifuging requirements which match the currently established centrifuge operating protocols to be subsequently processed by a centrifuge and an analyzer associated with said workcell. If a sample does not have centrifuging requirements which match the currently established centrifuge operating protocols, the sample is retained at the input station until the centrifuge operating protocols are changed appropriately. If a sample does have centrifuging requirements which match the currently established centrifuge operating protocols, the sample is processed in a routine manner by a centrifuge and then by either a chemistry analyzer or a coagulation analyzer depending upon whether the centrifuge is being operated with centrifuge protocols for clinical chemistry or coagulation testing. Typically, specimens to be automatically processed are provided to sample handling workcell 10 in capped containers The containers 20 are generally held in racks 18 that have additional identification indicia thereon. It should be understood that more than three analyzers 32, 38, and 42 may be linked by conveyor track 14; for purposes of simplicity, only three are shown. A remote analyzer 43 may be serviced by workcell 10 even though the remote analyzer 43 is not directly linked to workcell 10, for instance by an independent robotic system. The sample handling workcell 10 has a number of sensors 19 for detecting the location of a sample tube container 20 by means of identifying indicia placed on or within each sample tube carrier Conventional bar-code readers may be employed in such tracking operations. Centrifuge 24 and each analyzer 38, 42 and 32 are generally equipped with various robotic mechanisms 26 and 28, 40 and 44 or tracks 34 and 36, respectively, for removing a sample tube carrier 22 from track 14, moving the sample tube carrier 22 to and from centrifuge 24, to and from or into and out from analyzers 38, 42 and 32, respectively. Sample handling workcell 10 is controlled by a conventionally programmed computer 15, preferably a microprocessor based central processing unit CPU 15, housed as part of or separate from the system 10 to control movement of the sample

tube carrier 22 to each operating station 24, 30, 32, 38, 42 and 16 whereat various types of assay processing occurs, as described below. Such a CIM preferably employs a first display screen that is directly linked to a plurality of additional display screens containing on-line information about the operational status of plurality of interrelated automated devices as well as information describing the location of any specific sample and the status of clinical tests to be performed on the sample. The CIM is thus adapted to facilitate interactions between an operator and automated clinical analytical system 10 wherein the module comprises a visual touch screen adapted to display a menu including icons, scroll bars, boxes and buttons through which the operator may interface with the clinical analytical system and wherein the menu comprises a number of function buttons programmed to display functional aspects of the clinical analytical system. In the instance described hereinabove wherein analyzer 32 is, for example, a clinical chemistry analyzer 32 and analyzer 38 is a coagulation analyzer, as also mentioned, different centrifuge protocols must be established within centrifuge 24 in order to provide a properly pre-assay treated sample for testing by chemistry analyzer 32 or by coagulation analyzer As previously mentioned, sample containers 20 are provided with identification indicia readable by sensor 19 indicating the assay procedures to be accomplished upon the sample therein. Computer 15 is programmed to determine whether an assay is a clinical chemistry analysis or a coagulation analysis and which analyzers 32, 38 and 42 are adapted to perform such analyses. The present invention is a method for managing the different processes involved in handling samples that require differential centrifuging protocols within a clinical sample handling workcell As previously explained, combining both clinical chemistry and coagulation test samples on a single workcell 10 requires segregation of clinical chemistry and coagulation samples during the sample preparation process due to the aforementioned differential centrifuging protocols, involving either different spin rates or lengths of time or both. In one embodiment, these needs may be satisfied by providing a first centrifuge for pre-treating samples for subsequent clinical chemistry analysis and a second centrifuge for pre-treating samples for subsequent coagulation analysis. Alternately, discrete sample batches may be processed within a single centrifuge 24 having first and second operating protocols, respectively adjusted for subsequent clinical chemistry and coagulation analysis. Another alternative is for the laboratory to validate a set of centrifuge protocols that properly separate both chemistry and coagulation samples. The present invention is applicable in any of the above alternative situations. If a sample in a container 20 does not have centrifuging requirements which match the currently established centrifuge operating protocols, container 20 is replaced back into an available input rack 18 at station 16 and retained there until the centrifuge operating protocols are changed appropriately. To determine if a container 20 has centrifuging requirements which match the currently established centrifuge operating protocols, the identification indicia on a sample container indicating the assay procedures to be accomplished upon the sample therein are read by sensor 19 and this information is employed to make such a determination. When all samples in containers 20 in a rack 18 having centrifuging requirements which match the currently established centrifuge operating protocols have either been placed upon belt 14 in accord with the present invention or replaced into a rack 18 as a consequence of having centrifuging requirements that do not match the currently established centrifuge operating protocols, also in accord with the present invention. Containers 20 placed upon belt 14 are conveyed by belt 14 to centrifuge 24 whereat the appropriate centrifuge protocol is conducted on the sample within container Any containers 20 replaced into rack 18 as a consequence of having centrifuging requirements that do not match the currently established centrifuge operating protocols will be included within the next batch of samples to be subjected to centrifugation only after the centrifuge operating protocols are adjusted appropriately. This present invention thereby produces as close to a first-in-first-out processing order as can be achieved when there are conflicting centrifuging requirements. If there is more than one centrifuge 24 in workcell 10, for example device 42 also being a centrifuge, the present invention creates dedicated centrifuge batches for each of the multiple centrifuges with each centrifuge 24 being adapted to properly prepare clinical chemistry or coagulation samples by repeating the process described above for each different centrifuge. Depending on variety of samples being provided to workcell 10, it may thus be possible to have any combination of centrifuge batches being formed; for example, if both devices 24 and 42 are centrifuges, creating a two centrifuge workcell, then, as an example only, centrifuge 24 may be set up to

process clinical chemical samples and centrifuge 42 set up to process coagulation samples, or both centrifuges 24 and 42 may be set up to process clinical chemical samples, or both centrifuges 24 and 42 may be set up to process coagulation samples, or centrifuge 24 may be set up to process coagulation samples and centrifuge 42 set up to process chemistry samples. Such flexibility maximizes throughput of workcell 10 when the incoming sample load has a much greater content of either chemistry or coagulation samples. Clearly also, such an arrangement minimizes the affect of a single centrifuge failure. In addition, it may be desirable to have different centrifuging protocols for urine specimens vs. It is further foreseen that it may desirable to have different centrifuging protocols for urine vs. It may also be possible that the centrifuging protocols may be for samples to be processed in a user defined analyzer, selected from the analyzers 32, 38, 42 and 43, for example. Furthermore, it may be required to centrifuge certain coagulation samples more than one time before the sample can be presented to an analyzing device for analysis, in the event of sensitive coagulation assays like Protein S and other that are within this category. Thus, the centrifuging protocols may be different for different sample fluids based on the specific ordered assay. As explained above, in accord with the present invention, if the centrifuge protocols for Chemistry and Coagulation do not match one another, the samples to be processed by, for example, chemistry analyzer 32 or coagulation analyzer 38 will not be allowed to be centrifuged by centrifuge 24 at the same time. When a batch of samples in containers 20 have been transported by belt 24 to centrifuge 24, robotic devices 26 and 28 place containers into centrifuge bucket inserts and the inserts are placed in centrifuge As a more detailed illustration of the present invention, consider an instance wherein the required Chemistry and Coagulation centrifuging protocols are different. The first rack 18 to be processed establishes whether a Chemistry or Coagulation centrifuge batch will be started based on its contents. Operators load each rack 18 only with only chemistry sample containers 20 or only with coagulation sample containers 20 to improve overall processing efficiencies. The following processing steps are implemented and controlled by computer 15 1. System 10 is idle no racks 18 on workcell 10 2. Rack IDs are read and racks 18 are queued up for processing 4. First container 20 removed from an input rack 18 is identified to be classified as a Chemistry sample 5. First rack 18 becomes affiliated with a Chemistry centrifuge batch 6. Successive containers 20 are removed from rack 18 and sent to centrifuge 24 7. When the first rack 18 is emptied, the next queued input rack 18 is unloaded. If the first container 20 removed from said next queued input rack 18 is not a chemistry sample i.

Chapter 2 : Centrifuge - Wikipedia

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Laboratory centrifuge A wide variety of laboratory-scale centrifuges are used in chemistry, biology, biochemistry and clinical medicine for isolating and separating suspensions and immiscible liquids. They vary widely in speed, capacity, temperature control, and other characteristics. Laboratory centrifuges often can accept a range of different fixed-angle and swinging bucket rotors able to carry different numbers of centrifuge tubes and rated for specific maximum speeds. Controls vary from simple electrical timers to programmable models able to control acceleration and deceleration rates, running speeds, and temperature regimes. Ultracentrifuges spin the rotors under vacuum, eliminating air resistance and enabling exact temperature control. Zonal rotors and continuous flow systems are capable of handing bulk and larger sample volumes, respectively, in a laboratory-scale instrument. DNA preparation is another common application for pharmacogenetics and clinical diagnosis. DNA samples are purified and the DNA is prepped for separation by adding buffers and then centrifuging it for a certain amount of time. The blood waste is then removed and another buffer is added and spun inside the centrifuge again. Once the blood waste is removed and another buffer is added the pellet can be suspended and cooled. Proteins can then be removed and the entire thing can be centrifuged again and the DNA can be isolated completely. Gas centrifuge Other centrifuges, the first being the Zippe-type centrifuge , separate isotopes , [9] and these kinds of centrifuges are in use in nuclear power and nuclear weapon programs. Gas centrifuges are used in uranium enrichment. The heavier isotope of uranium uranium in the uranium hexafluoride gas tends to concentrate at the walls of the centrifuge as it spins, while the desired uranium isotope is extracted and concentrated with a scoop selectively placed inside the centrifuge. The first centrifuges used for human research were used by Erasmus Darwin, the grandfather of Charles Darwin. The first largescale human centrifuge designed for Aeronautical training was created in Germany in The centrifuge at Brooks City Base is operated by the United States Air Force School of Aerospace Medicine for the purpose of training and evaluating prospective fighter pilots for high-g flight in Air Force fighter aircraft. Exposure to this simulated gravity would prevent or reduce the bone decalcification and muscle atrophy that affect individuals exposed to long periods of freefall. Samples can be exposed to a maximum of 20 times Earth gravity. With its four arms and six freely swing out gondolas it is possible to expose samples with different g-levels at the same time. Gondolas can be fixed at eight different position. Depending on their locations one could e. Experiments performed in this facility ranged from zebra fish, metal alloys, plasma, [14] cells, [15] liquids, Planaria, [16] Drosophila [17] or plants Industrial centrifugal separator[edit] Industrial centrifugal separator is a coolant filtration system for separating particles from liquid like, grinding machining coolant. It is usually used for non-ferrous particles separation such as, silicon, glass, ceramic, and graphite etc. The filtering process does not require any consumption parts like filter bags, which saves the earth from harm. Centrifuge acceleration is applied to scale models to scale the gravitational acceleration and enable prototype scale stresses to be obtained in scale models. Problems such as building and bridge foundations, earth dams, tunnels, and slope stability, including effects such as blast loading and earthquake shaking. Researchers reported that the high-gravity level can effectively affect the phase composition and morphology of the products. Washing machines are designed to act as centrifuges to get rid of excess water in laundry loads. Centrifuges are used in the attraction Mission: SPACE , located at Epcot in Walt Disney World , which propels riders using a combination of a centrifuge and a motion simulator to simulate the feeling of going into space. In soil mechanics , centrifuges utilize centrifugal acceleration to match soil stresses in a scale model to those found in reality. Large industrial centrifuges are commonly used in water and wastewater treatment to dry sludges. The resulting dry product is often termed cake, and the water leaving a centrifuge after most of the solids have been removed is called centrate. Large industrial centrifuges are also used in the oil industry to remove solids from the drilling fluid. Disc-stack centrifuges used by some companies in the oil sands industry to separate small amounts of water and solids from bitumen

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Centrifuges are used to separate cream remove fat from milk; see Separator milk. Mathematical description[edit] Protocols for centrifugation typically specify the amount of acceleration to be applied to the sample, rather than specifying a rotational speed such as revolutions per minute. This distinction is important because two rotors with different diameters running at the same rotational speed will subject samples to different accelerations. A 19th-century hand cranked laboratory centrifuge.

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Chapter 3 : The History of the Centrifuge - Tested

Favorited: 18 Photo ID: "The beast" or "la Bestia" snow blower Xrot mt # is clearing track 3 of Ospizio Bernina station at 6 in the morning, the centrifuging units are extended to a width of 6 m.

Sometimes scientists need to break down small things into even smaller things. Tweet Sometimes scientists need to break down small things into even smaller things. Blood needs to become platelets, plasma, and cells. Cells need to become organelles. Gases need to become isotopes. One of the best ways to achieve this is to put these items into a centrifuge, spin them around at super high speeds, and use the force of that movement to break them up into their individual parts. The first centrifuge was created by Antonin Prandtl, a German cafe owner. There is little known about Antonin or his design, but it likely was created sometime during the mids possibly around Flickr user gemmerich via creative commons The next big upgrade to the device, and the one that brought the centrifuge into the laboratory, was invented by Swedish Chemist Theodor Svedberg. In his lab Svedberg was studying colloids -- a substance, which, in the simplest possible terms, is made up of matter in one type of state evenly dispersed within matter that is in another type of state. Whipped cream, for example, is a colloid of gas and liquid. Svedberg wanted to better understand the much more complex than whipped cream colloids he was studying and so he created a device that would separate the colloids out into their individual parts. The findings that came from his use of the centrifuge, that particles settled based on their size and weight, which could be used as a method to measure them, eventually won him the Nobel Prize in Chemistry. Over the next many decades the centrifuge saw a whole series of updates by several different researchers. One researcher used compressed air to make it move at higher speeds. Others figured out the steps necessary to use the device collect the sediment that was separated out after the centrifuging was complete. And one team discovered how to use it to filter out viruses using a vacuum. In the s Gernot Zippe, a German researcher living and working at a Russian prison camp for POW scientists, was tasked with finding out a way to isolate Uranium Getting access to the isotope was considered a big prize because its particles could very easily be split to produce atomic energy. According to a New York Times story about Zippe, he and a team of 60 researchers realized that to concentrate enough of the U they would need hundreds or thousands of them spinning continuously for years. Zippe told the Times: I was a young man. I had no idea how to do it. But I decided to do my best. The device uses a magnetic field and heat to achieve the separation of U from uranium gas. Today, centrifuges are controlled by microprocessors. Some can be used under high pressure or super cooled. The devices are so common and ubiquitous you can even buy one on Amazon. Science could never get done without the right tools. And all that gear has to come from somewhere.

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Chapter 4 : Laboratory centrifuge - Wikipedia

STG Lube Oil Tank Cleaning (MOT) Opening inspection cover of Dirty oil Tank (DOT) of STG/Phase-II, inspection of tank, thorough cleaning of DOT and keeping ready for oil filling, arrangement of proper flexible hose, pumping of oil from STG MOT to DOT of STG/Phase-II (Hiring of pump, hose, T&Ps etc., are contractor scope), centrifuging of.

More particularly, the present invention relates to a method for managing the different processes involved in pre-assay treatment of samples that require differential centrifuging prior to analysis by such analyzers within such an automated clinical sample handling workcell BACKGROUND OF THE INVENTION A wide variety of automated chemical analyzers are known in the art and are continually being improved to increase analytical menu and throughput, reduce turnaround time, and decrease requisite sample volumes. Such improvements, while useful in themselves, may be hampered if sufficient corresponding advances are not made in the areas of pre-analytical sample preparation and handling. Sample preparation and handling includes sorting, batch preparation, centrifugation of sample tubes to separate sample constituents, cap removal to facilitate fluid access, and the like. Automated sample preparation systems are commercially available and these generally include the use of conveyor systems for conveying specimens to clinical analyzers, such as those described in U. A disadvantage of many of these conveyor systems is that they are an integrated and dedicated part of a total integrated system, which system includes special analyzers and other handling equipment. More universal sample handling systems have more recently been introduced, like that described in U. For purposes of certain laboratory clinical chemistry tests, plasma, obtained from whole blood by centrifugation, is most often used in the analysis. To prevent clotting, an anticoagulant such as citrate or heparin is added to the blood specimen immediately after it is obtained or the anticoagulant is present in the evacuated blood collection tube when the patient sample is originally obtained. The specimen is then centrifuged to separate plasma from blood cells. For many biochemical laboratory tests, plasma and blood serum can be used interchangeably. Serum resembles plasma in composition but lacks the coagulation factors. It is obtained by letting a blood specimen clot prior to centrifugation. For this purpose, a serum-separating tube may be used which contains an inert catalyst such as glass beads or powder to facilitate clotting as well as a portion of gel with a density designed to sit between the liquid and cellular layers in the tube after centrifugation, making separation more convenient. Tests of coagulation require all clotting factors to be preserved. Serum, therefore, is inappropriate for these tests. A citrated evacuated blood collection tube is usually used, as the anticoagulant effects of citrate is dependent upon concentration and can be reversed for testing. In addition, serum is preferred for many tests as the anticoagulants in plasma can sometimes interfere with certain analytical results. Different anticoagulants interfere with different tests; using serum means the same sample can be used for many tests. In protein electrophoresis, using plasma causes an additional band to be seen, which might be mistaken for a paraprotein. Clinical chemistry diagnostic analyzers associated with such sample preparation systems are adapted to automatically perform chemical assays and immunoassays on biological samples such as urine, blood serum, plasma, cerebrospinal liquids and the like, these samples generally being contained in capped sample tubes. From these signals the concentration of the analyte in the sample may be calculated. Another type of sample analysis, coagulation tests, is used to diagnosis hemorrhagic conditions such as hemophilia, where one or more of the twelve blood clotting factors may be defective. Popular laboratory coagulation tests typically employ turbidimetric or other measuring techniques. For most coagulation tests, whole-blood samples are collected into a citrate vacutainer and then centrifuged to obtain a plasma sample. The assay is performed with plasma to which a sufficient excess of calcium has been added to neutralize the effect of citrate. The PT reported as time in seconds, represents how long a plasma sample takes to clot after a mixture of thromboplastin and calcium are added. The aPTT measures the clotting time of plasma, from the activation of factor XII by a reagent a negatively charged activator such as silica and a phospholipid through the formation of a fibrin clot. Activated clotting time ACT is test that is used to monitor the effectiveness of high dose heparin therapy. ACT tests however use undiluted blood from sites which have not been contaminated by heparin infusion. The whole blood sample is transferred to appropriate

test vial, mixed with the activator and a timer activated on an ACT analyzer. The overall analytical throughput of a laboratory may be increased by linking together analyzers of different types, each adapted to perform a certain menu of assays within a single workcell. However, a problem arises when both clinical chemistry and coagulation analyzes are linked to the same workcell because different centrifuging processes may be required to produce different properly separated samples for the different types of tests. From the above discussion it is evident that analytical tests may be performed on whole blood, plasma or serum, and that sometimes either plasma or serum may be used. Thus, different centrifugation processes may be required for different samples depending upon what tests are to be performed by which analyzers. Thus, while automated systems have advanced sample handling and processing throughput, what has not been addressed is the difficulty associated with handling samples that require differential centrifuging, different centrifuge protocols, within automated clinical sample handling workcells. SUMMARY OF THE INVENTION The present invention provides for detecting and classifying patient samples at the input station of an automated clinical sample handling workcell with two or more independent coagulation and clinical chemistry analyzers prior to analysis and enabling only those samples that have pre-analysis centrifuging requirements which match the currently established centrifuge operating protocols to be subsequently processed by a centrifuge and an analyzer associated with said workcell. If a sample does not have centrifuging requirements which match the currently established centrifuge operating protocols, the sample is retained at the input station until the centrifuge operating protocols are changed appropriately. If a sample does have centrifuging requirements which match the currently established centrifuge operating protocols, the sample is processed in a routine manner by a centrifuge and then by either a chemistry analyzer or a coagulation analyzer depending upon whether the centrifuge is being operated with centrifuge protocols for clinical chemistry or coagulation testing. Typically, specimens to be automatically processed are provided to sample handling workcell 10 in capped containers The containers 20 are generally held in racks 18 that have additional identification indicia thereon. It should be understood that more than three analyzers 32, 38, and 42 may be linked by conveyor track 14; for purposes of simplicity, only three are shown. A remote analyzer 43 may be serviced by workcell 10 even though the remote analyzer 43 is not directly linked to workcell 10, for instance by an independent robotic system. The sample handling workcell 10 has a number of sensors 19 for detecting the location of a sample tube container 20 by means of identifying indicia placed on or within each sample tube carrier Conventional bar-code readers may be employed in such tracking operations. Centrifuge 24 and each analyzer 38, 42 and 32 are generally equipped with various robotic mechanisms 26 and 28, 40 and 44 or tracks 34 and 36, respectively, for removing a sample tube carrier 22 from track 14, moving the sample tube carrier 22 to and from centrifuge 24, to and from or into and out from analyzers 38, 42 and 32, respectively. Sample handling workcell 10 is controlled by a conventionally programmed computer 15, preferably a microprocessor based central processing unit CPU 15, housed as part of or separate from the system 10 to control movement of the sample tube carrier 22 to each operating station 24, 30, 32, 38, 42 and 16 whereat various types of assay processing occurs, as described below. Such a CIM preferably employs a first display screen that is directly linked to a plurality of additional display screens containing on-line information about the operational status of plurality of interrelated automated devices as well as information describing the location of any specific sample and the status of clinical tests to be performed on the sample. The CIM is thus adapted to facilitate interactions between an operator and automated clinical analytical system 10 wherein the module comprises a visual touch screen adapted to display a menu including icons, scroll bars, boxes and buttons through which the operator may interface with the clinical analytical system and wherein the menu comprises a number of function buttons programmed to display functional aspects of the clinical analytical system. In the instance described hereinabove wherein analyzer 32 is, for example, a clinical chemistry analyzer 32 and analyzer 38 is a coagulation analyzer, as also mentioned, different centrifuge protocols must be established within centrifuge 24 in order to provide a properly pre-assay treated sample for testing by chemistry analyzer 32 or by coagulation analyzer As previously mentioned, sample containers 20 are provided with identification indicia readable by sensor 19 indicating the assay procedures to be accomplished upon the sample therein. Computer 15 is programmed to determine whether an assay is a clinical chemistry analysis or a coagulation analysis and

which analyzers 32, 38 and 42 are adapted to perform such analyses. The present invention is a method for managing the different processes involved in handling samples that require differential centrifuging protocols within a clinical sample handling workcell As previously explained, combining both clinical chemistry and coagulation test samples on a single workcell 10 requires segregation of clinical chemistry and coagulation samples during the sample preparation process due to the aforementioned differential centrifuging protocols, involving either different spin rates or lengths of time or both. In one embodiment, these needs may be satisfied by providing a first centrifuge for pre-treating samples for subsequent clinical chemistry analysis and a second centrifuge for pre-treating samples for subsequent coagulation analysis. Alternately, discrete sample batches may be processed within a single centrifuge 24 having first and second operating protocols, respectively adjusted for subsequent clinical chemistry and coagulation analysis. Another alternative is for the laboratory to validate a set of centrifuge protocols that properly separate both chemistry and coagulation samples. The present invention is applicable in any of the above alternative situations. If a sample in a container 20 does not have centrifuging requirements which match the currently established centrifuge operating protocols, container 20 is replaced back into an available input rack 18 at station 16 and retained there until the centrifuge operating protocols are changed appropriately. To determine if a container 20 has centrifuging requirements which match the currently established centrifuge operating protocols, the identification indicia on a sample container indicating the assay procedures to be accomplished upon the sample therein are read by sensor 19 and this information is employed to make such a determination. When all samples in containers 20 in a rack 18 having centrifuging requirements which match the currently established centrifuge operating protocols have either been placed upon belt 14 in accord with the present invention or replaced into a rack 18 as a consequence of having centrifuging requirements that do not match the currently established centrifuge operating protocols, also in accord with the present invention. Containers 20 placed upon belt 14 are conveyed by belt 14 to centrifuge 24 whereat the appropriate centrifuge protocol is conducted on the sample within container Any containers 20 replaced into rack 18 as a consequence of having centrifuging requirements that do not match the currently established centrifuge operating protocols will be included within the next batch of samples to be subjected to centrifugation only after the centrifuge operating protocols are adjusted appropriately. This present invention thereby produces as close to a first-in-first-out processing order as can be achieved when there are conflicting centrifuging requirements. If there is more than one centrifuge 24 in workcell 10, for example device 42 also being a centrifuge, the present invention creates dedicated centrifuge batches for each of the multiple centrifuges with each centrifuge 24 being adapted to properly prepare clinical chemistry or coagulation samples by repeating the process described above for each different centrifuge. Depending on variety of samples being provided to workcell 10, it may thus be possible to have any combination of centrifuge batches being formed; for example, if both devices 24 and 42 are centrifuges, creating a two centrifuge workcell, then, as an example only, centrifuge 24 may be set up to process clinical chemical samples and centrifuge 42 set up to process coagulation samples, or both centrifuges 24 and 42 may be set up to process clinical chemical samples, or both centrifuges 24 and 42 may be set up to process coagulation samples, or centrifuge 24 may be set up to process coagulation samples and centrifuge 42 set up to process chemistry samples. Such flexibility maximizes throughput of workcell 10 when the incoming sample load has a much greater content of either chemistry or coagulation samples. Clearly also, such an arrangement minimizes the affect of a single centrifuge failure. In addition, it may be desirable to have different centrifuging protocols for urine specimens vs. It is further foreseen that it may desirable to have different centrifuging protocols for urine vs. It may also be possible that the centrifuging protocols may be for samples to be processed in a user defined analyzer, selected from the analyzers 32, 38, 42 and 43, for example. Furthermore, it may be required to centrifuge certain coagulation samples more than one time before the sample can be presented to an analyzing device for analysis, in the event of sensitive coagulation assays like Protein S and other that are within this category. Thus, the centrifuging protocols may be different for different sample fluids based on the specific ordered assay. As explained above, in accord with the present invention, if the centrifuge protocols for Chemistry and Coagulation do not match one another, the samples to be processed by, for example, chemistry analyzer 32 or coagulation analyzer 38 will not be allowed to be centrifuged by

centrifuge 24 at the same time. When a batch of samples in containers 20 have been transported by belt 24 to centrifuge 24, robotic devices 26 and 28 place containers into centrifuge bucket inserts and the inserts are placed in centrifuge As a more detailed illustration of the present invention, consider an instance wherein the required Chemistry and Coagulation centrifuging protocols are different. The first rack 18 to be processed establishes whether a Chemistry or Coagulation centrifuge batch will be started based on its contents. Operators load each rack 18 only with only chemistry sample containers 20 or only with coagulation sample containers 20 to improve overall processing efficiencies. The following processing steps are implemented and controlled by computer 15 1. System 10 is idle no racks 18 on workcell 10 2. Rack IDs are read and racks 18 are queued up for processing 4. First container 20 removed from an input rack 18 is identified to be classified as a Chemistry sample 5. First rack 18 becomes affiliated with a Chemistry centrifuge batch 6. Successive containers 20 are removed from rack 18 and sent to centrifuge 24 7. When the first rack 18 is emptied, the next queued input rack 18 is unloaded. If the first container 20 removed from said next queued input rack 18 is not a chemistry sample i. If the first container 20 removed from said next queued input rack 18 is a chemistry sample it is placed on conveyor track 14 and delivered to centrifuge 24 and each container 20 in turn from that rack 18 is likewise processed. When the all chemistry containers 20 have been removed from the queued input racks 18 or the centrifuge buckets are full, the centrifuge batch is spun. If racks 18 with coagulation samples therein were previously examined then such racks 18 are loaded to form a Coagulation centrifuge batch. If no racks 18 or containers 20 were previously examined and bypassed, then the next centrifuge batch would be determined by the next queued input container 20 picked up for processing.

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Chapter 5 : Is Anyone Centrifuging Oil? - Page 2 - www.nxgvision.com : 4x4 and Off-Road Forum

Multi-Purpose, one compact centrifuge that accepts: Swing out rotors (12 x 15ml or 8 x 50ml) High Speed microtube rotors (up to 18,xg) Low-Medium speed fixed angle rotors for 15ml to 50ml The Z is a compact and economical centrifuge with a series of rotor options making.

Laboratory centrifuge There are various types of centrifugation: Differential centrifugation , often used to separate certain organelles from whole cells for further analysis of specific parts of cells Isopycnic centrifugation , often used to isolate nucleic acids such as DNA Sucrose gradient centrifugation , often used to purify enveloped viruses and ribosomes, and also to separate cell organelles from crude cellular extracts There are different types of laboratory centrifuges: Microcentrifuges devices for small tubes from 0. Centrifuge tubes[edit] Centrifuge tubes also referred to as Eppendorf Tubes, Microfuge Tubes, and Microcentrifuge Tubes are precision-made, high-strength tubes of glass or plastic made to fit exactly in rotor cavities. They may vary in capacity from 50 mL down to much smaller capacities used in microcentrifuges used extensively in molecular biology laboratories. Glass centrifuge tubes can be used with most solvents, but tend to be more expensive. They can be cleaned like other laboratory glassware , and can be sterilized by autoclaving. Small scratches from careless handling can cause failure under the strong forces imposed during a run. Glass tubes are inserted into soft rubber sleeves to cushion them during runs. Plastic centrifuge tubes, especially tend to be less expensive and, with care, can be just as durable as glass. Water is preferred when plastic centrifuge tubes are used. They are more difficult to clean thoroughly, and are usually inexpensive enough to be considered disposable. Disposable plastic "microlitre tubes" of 0. They are molded from a flexible transparent plastic similar to polythene , are semi-conical in shape, with integral, hinged sealing caps. Larger samples are spun using centrifuge bottles, which range in capacity from to millilitres. Although some are made of heavy glass, centrifuge bottles are usually made of shatterproof plastics such as polypropylene or polycarbonate. Sealing closures may be used for added leak-proof assurance. Safety[edit] An Eppendorf laboratory centrifuge The load in a laboratory centrifuge must be carefully balanced. This is achieved by using a combination of samples and balance tubes which all have the same weight or by using various balancing patterns without balance tubes. This force imbalance strains the spindle and may result in damage to the centrifuge or personal injury. Some centrifuges have an automatic rotor imbalance detection feature that immediately discontinues the run when an imbalance is detected. Before starting a centrifuge, an accurate check of the rotor and lid locking mechanisms is mandatory. A spinning rotor can cause serious injury if touched. Modern centrifuges generally have features that prevent accidental contact with a moving rotor as the main lid is locked during the run. For example, the new NuAire NuWind centrifuge has an automatic lid locking mechanism that tightly locks the centrifuge lid. The chamber can be accessible only when the rotor has come to a complete stop. Rotor failure, caused by mechanical stress from the high forces imparted by the motor, can occur due to manufacturing defects, routine wear and tear, or improper use and maintenance. Such a failure can be catastrophic failure , especially with larger centrifuges, and generally results in total destruction of the centrifuge. While centrifuges generally have safety shielding to contain these failures, such shielding may be inadequate, especially in older models, or the entire centrifuge unit may be propelled from its position, resulting in damage to nearby personnel and equipment. Uncontained rotor failures have shattered laboratory windows and destroyed refrigerators and cabinetry. To reduce the risk of rotor failures, centrifuge manufactures specify operating and maintenance procedures to ensure that rotors are regularly inspected and removed from service or derated only operated at lower speeds when they are past their expected lifetime. To prevent contamination of the laboratory, rotor lids with special aerosol-tight gaskets are available. The rotor can be loaded with the samples within a hood and the rotor lid fixed on the rotor. Afterwards, the aerosol-tight system of rotor and lid is transferred to the centrifuge. The rotor can then be fixed within the centrifuge without opening the lid. After the run, the entire rotor assembly, including the lid, is removed from the centrifuge to the hood for further steps, maintaining the samples within a closed system. A ThermoFisher laboratory bench-top centrifuge.

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Chapter 6 : Centrifuge at Thomas Scientific

Methods. The laboratory studied serves the clinical chemistry demands of a medical undergraduate teaching hospital of beds. The period of study was the usual daytime () operating window, with emergency, evening, and weekend hours supported by a separate laboratory.

This invention relates to a device for removing liquids from wet processed cakes of rayon or other filamentary material, whether natural or artificial. It is an object of the invention to provide a device for conveying the cakes being operated upon in a continuous circuit past a loading and unloading station with means, for centrifuging them in a portion of the circuit and with means for slowing the centrifuge motors to a stop by 1 reversal of electric current supplied thereto. It is also an object to provide a centrifuging device of this type with a means for automatically ejecting the cake at least partially from the centrifuge pot after substantial reduction of speed of the centrifuge as it approaches the loading and unloading station. Other objects of the invention will appear from the drawings and the description thereof. In the drawings, illustrative of the invention, Figure 1 shows a plan view of the device, Figure 2 shows an elevational view of the device, Figure 3 is a plan view of one of the conveyor platforms, Figure 4 is a transverse elevation with parts in cross-section looking in the direction of the lines IV-IV of Figure 1, Figure 5 is a similar transverse elevation with parts in cross-section looking in the direction of lines V-V of Figure 1, Figure 6 is a side elevation of the portion of the device shown in Figure 5 with parts cut away, Figure 7 is a transverse elevation corresponding to that of Figure 5 of a modification of the cake ejector. In general, the device comprises a trough 2 in the form of a loop through which a series of centrifuging buckets 3 the walls of which may be perforated in conventional manner may be continuously drawn past a loading and unloading station A, a centrifuging station B, and the centrifuge stopping station C. These several stations are adjacent to one another so that the buckets pass through them in succession. A given machine may contain a single one of each of the said stations or it may comprise a plurality of such sequential stations, as shown in Figure 1 in which two such sequential treatment stages constitute the machine. An operator may be placed at each of the stations A to unload and to reload the buckets with cakes K as they pass. As each bucket approaches the unloading station A, a suitable mechanism provided at a station D adjacent thereto automatically ejects the cake from the bucket, at least partially, to facilitate removal of the cake by hand or otherwise at the unloading station A. Each of the buckets 3 is provided with an individual motor 4 which is mounted upon a suitable platform 5 which serves as a conveyor for both the motor and the bucket. The trough 2 is provided with a central slot 6 running longitudinally thereof so that the spindle 7 connecting the 0 bucket with the motor may be moved through the trough without interference therefrom. Each individual motor is provided with electrical contact members 8 which may consist of arms carrying brush or roller contact elements which are adapted to make contact with bus bars 9 provided along the length of the trough through station B in order to drive the bucket while it passes through that station. These bus bars 9 are suitably protected within a casing shown generally at 10 in Figure 2 and are suitably connected electrically by the terminals II shown diagrammatically in Figure 2 to a source of electrical power 12, which as shown is a three-phase type, at the junction 12a. The device is provided with additional bus bars in housing 13 along station C. These latter bus bars are not connected with those at station B, and are connected by suitable terminals 14 to the three-phase power supply 12 in a manner shown diagrammatically at 12b in Figure 2 such that the current within the motor opposes its motion acquired along station B, thereby reducing its speed to effectively stop it. The length of the bus bars at station C are correlated to the speed of the buckets past them so as to bring the buckets to a substantially complete stop. This action is generally termed "plugging" and may be so referred to hereinafter. If desired, other means for reducing the speed of the centrifugal bucket may be provided along station C, one example being a braking means. The trough may be covered, though preferably not at the stations where it is desired to load and unload the bucket. Preferably the covers 15 are removable, and they may be hinged to the trough in any suitable fashion. Suitable supports 16 are provided on either side of the trough at spaced points therealong and drain pipes T1 may be connected to the lowermost portions of the trough bottom, and these pipes may be connected to a drain header or headers.

Referring more particularly to Figures 3 and 4, the conveyor platform 6 may be provided with wheels 18 which are adapted to ride within suitable oppositely disposed rails 19 which serve to guide the conveyor with its motor and bucket through the circuit in the trough. Preferably, three wheels are disposed upon the platform as shown in Figure 3 to facilitate the making of any curves within the apparatus. A chain 20 which runs the length of the machine is fastened to the upper surface of the platform at one edge and is adapted to be driven by the sprockets 21 and 22 shown in Figure 1. Each bucket is provided with an ejector plate 23 in the shape of a disk or annulus which is slidable axially within the bucket. In the modification shown in Figure 4, this annulus or disk is fastened to a plurality, three being shown, of rods 24 extending through suitable apertures 25 within the base of the bucket and have their lower ends fastened to an annular plate 26 beneath the bucket. This annular plate may be provided with an inner sleeve 27 which is adapted to slide about the hub 28 of the bucket. This ejector means is carried along with each bucket and comes into play for ejecting the plate 23 from the bucket at station D. The operation of the ejector means is shown in Figures 5 and 6. Two vertical shafts 29 and 30 provided with a positive driving interconnection, such as by the two sprockets 31 and 32 and the driving chain 33 at their lower ends, are provided with bevel gears 34 and 35 at their upper ends and one 30 of such shafts is provided with a driving sprocket 36 which is in mesh with the chain 20 by which it is driven. Two bevel gears and 38 driven by the bevel gears 34 and respectively on the vertical shafts 29 and 30 transmit motion through suitable supported horizontal shafts 39 and 40 to the quick-rise cams 41 and 42 mounted thereon. Two vertical rods 43 and 44 extending through suitable bearing surfaces 45 and. These rods 43 and 44 may be provided with rollers 49 and 50 at their upper end which engage the annular plate 26 beneath the bucket and effect ejection of the cake from the bucket upon rise thereof. The cams 41 and 42 are so shaped and the driving mechanism therefor is so related to the shape thereof that no vertical motion of the rods 43 and 44 is effected until 5 after the annular plate 26 comes into position over the bearing rollers 49 and The extent of ejection of the cake from the bucket may be any proportion desired, this being controlled by the selection of the cams 41 and In this manner, an operator may readily insert his hand within the cake to the bottom thereof or to any extent desired and obtain a firm grip thereupon in a manner which will not 6 distort the cake or tend to remove the wrapping, which may be of the cylindrical stocking type of textile wrapping, extending about both the interior and exterior of the cake from the interior of the cake. In this figure, a vertical shaft 51 is provided with the take-off sprocket 52 in mesh with the chain A horizontal shaft 53 carrying the cams 54 and 55 may be driven by the 71 vertical shaft 51 by means of the bevel gears 56 and The cams 54 and 55 cooperate with the circular lifting plate 58 connected by the vertical rod 59 to the ejector plate 60 within the bucket. The bucket is provided with a hollow driving shaft 61 which extends through the entire motor so that this rod may reciprocate vertically within the hollow shaft. While preferred embodiments of the invention have been shown, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims. What I claim is: In apparatus for treating filamentary material, a plurality of centrifugal buckets, axially movable means in said buckets comprising a platform for supporting filamentary material, a plurality of motors, spindles concentric with the movable means and connecting the motors directly with the buckets for driving said buckets, means for continuously moving said motors and buckets in a predetermined path, means for operating said motors during a portion of said motion, means for reducing the speed of said motors to bring the buckets to a substantially complete stop during a second portion of said motion, and cam means along a third portion of said path 5 arranged to axially move said movable means to at least partially eject said filamentary material from said buckets when they pass said portion. In apparatus for treating filamentary material, a plurality of centrifugal buckets, axially movable means in each of said buckets comprising a platform for supporting filamentary material, said means being provided with a vertically reciprocable operating member outside said Sbucket, a plurality of motors, spindles concentric with the corresponding operating members and connecting the motors directly with the buckets for driving said buckets, means for continuously moving said motors and buckets in a predetermined path, means for operating said motors during a portion of said motion, means for reducing the speed of said motors to bring the buckets to a substantially complete stop during a second portion of said motion, and cam means Salong a third portion of said path for elevating said operating member when it passes said portion. In apparatus for

treating filamentary material, a plurality of centrifugal buckets, axially 0 movable means in each of said buckets comprising a platform for supporting filamentary material, said means being provided with a vertically reciprocable operating member outside said bucket, a Plurality of motors, spindles concen5 tric with the corresponding operating members and connecting the motors directly with the buckets for driving said buckets, means for continuously moving said motors and buckets in a predetermined path, means for operating said motors during a portion of said motion, andcam means along a different portion of said path arranged to elevate said operating member when it passes said portion. In apparatus for treating filamentary material, a plurality of centrifugal buckets, axially movable means in each of said buckets for sup-. In apparatus for treating filamentary material, a plurality of centrifugal buckets, axially movable means in each of said buckets camprilidng a platform for supporting filamentary material, said means being provided with a vertically reciprocable operating member outside said buckets, a plurality of motors, spindles concentric with the corresponding operating members and connecting the motors directly with the buckets for driving said buckets, means for continuously moving said motors and buckets in a pre-determined path, means for operating said motors during a portion of said motion, rotatable cam means along a different portion ofsaid path arranged to elevate said operating member when it passes said portion, means for rotating said cam means, and driving means for said cam rotating means.

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Chapter 7 : Centrifuging machine - AMERICAN VISCOSE CORP

FLSmidth Ludowici is the world leader in coarse coal centrifuges. Our VM range has proven the test of time, and the VM is the world's largest high capacity coarse coal centrifuge. FLSmidth Ludowici offers an advanced design and highly qualified staff to ensure prompt and accurate advice on process applications, installation and spare.

Cumulative plot of number of samples per centrifuge run. As one example, the efficiency of the observed centrifugal cycle is given by: This does not take into account the load and unload times, which could probably be reduced further by use of automated technology. Two other measures of efficiency can be calculated. Because there are six centrifuges working within an operating window of 8 h, then there are 48 centrifuge hours available. Of these, only Even this is not a true overall measure because it does not take into account the number of sample places. The total capacity is given by the number of sample places multiplied by the time available. This equates to 55 tube minutes. There were actually 84 centrifugal runs with a mean operation time of This reduces the overall efficiency to The two main reasons for these low efficiencies are the delay inherent in the staff not emptying the centrifuge immediately after it has stopped rotating and the less than optimum batch size. An examination of the graph of sample delay time vs h clock time shows no particular trends or features that might point to operational constraints on the staff. The delays are completely random in nature and could have been triggered by the need to deal with telephone calls, measurement of urine volumes, or the discussion of problems with other sections of the laboratory. The best way in which this factor centrifuge unload delay could be minimized is to use some form of automation. The plot of centrifugal rotor spin time vs h clock time showed wide variability ranging from This suggests that operational staff are using the facility to change spin time to expedite work at the end of the day, possibly prejudicing sample quality as a result. Plots of the load time, unload time, and total operation time for each centrifugal run vs h clock time showed no cardinal features that would suggest that the overall process of centrifugation was subject to the intrusion of structured outside factors. Nevertheless, these times could be made more consistent and efficient by the use of automation. It is interesting to note that in only 3 of the 84 centrifugal runs recorded were the staff in attendance at the centrifuge before it had stopped. This is, therefore, not an important consideration in centrifuge activity because the staff were usually employed elsewhere during the majority of centrifugal runs. The mean run time was Given the sample preparation time of 29 s, improvements in the centrifugal cycle will, therefore, represent substantial operational gains. The principal conclusions from this part of the study are: The delays observed in emptying the centrifuge must be avoided. The centrifuge should be used to its fullest capacity for each run. The loading and unloading parts of the cycle time should be minimized. Control of centrifuge spin speed and spin period should be fixed at an agreed level to achieve authorized g values. Attention to these factors should increase the efficiency and quality of centrifuge operation. Therefore, consider an ideal laboratory in which samples are presented at the regular rate of 1 per minute per 8-h day , and that the centrifuge available has sample places, with a centrifugation spin period of 10 min. If this centrifuge is used to full capacity, then early samples will be delayed until the centrifuge is full. It was observed that the rate of sample input to the laboratory ranged from 44 to samples per hour. However, the highest input rate of samples was within the last hour of the working day, and these samples arrive too late to be analyzed that day because the analyzer used has substantial shutdown time. Because they are not emergency samples, then any results generated from analysis would not be clinically utilized until the next day anyway. There is a minimum delay time for the appearance of the first sample, which is conditioned by the need to provide an adequate separation of erythrocytes from plasma or serum. The most important feature is that it allows centrifugation of conventional blood collection tubes up to a diameter of 16 mm and a length of mm and does not require the additional complications of robotic arm ancillaries. The Multifuge operates by centrifuging each sample as a discrete entity in individually sealed rotors mounted in a rotating carousel. The carousel carries multiple rotors. Each rotor holds only one sample. Thus, there is continuous serial input and output. The principle is shown diagrammatically in Fig. Power to each rotor is supplied via permanent magnets built into the rotor as it passes stator coils. Thus, during the rotation of the carousel, each rotor

becomes a separate DC brushless motor. Each rotor is fully powered when it is in juxtaposition to the stator coils, with some short-term loss of power as the rotor transits from one stator to the next. This interval is very small, and to all practical intents and purposes, the power application is continuous. The centrifuge is designed to operate at user-selectable rotor speeds of between and rpm, yielding g. Lower speeds may be selected if required, and the rotor has been tested up to 24 rpm. This centrifuge contains 12 rotors, and it is the equivalent of 12 separate centrifuges in which the loading capacity is fully utilized, providing samples are available. The only instance of reduced efficiency of operation arises if the centrifuge is not kept continuously fed with samples. Open in new tab Figure 2. Front a and side b elevations of the Multifuge, showing the horizontally mounted carousel A supporting the rotors B. The 12 rotor slots are shown in a. The carousel carrying the individual rotors can itself be rotated around any axial position ranging from vertical to horizontal, but this choice can only be made at the point of manufacture and is not user selectable. The current instrument deploys the carousel around a horizontal axis. The horizontal axis was chosen because this effectively reduces the footprint size. Irrespective of which angle of axis is used, the individual rotors are loaded or unloaded when the rotor is suspended along a horizontal axis and the sample carrier is at its lowest position. This allows the rotor to be stopped in a vertical position, so that the opening of the sample carrier door allows the sample to drop under the force of gravity into a waiting holder to exit the centrifuge. In a conventional swing centrifuge during centrifugation, a sample tube usually is parallel to the radius of rotation i. In the conventional swing centrifuge, the sample is in the same plane of rotation, but for a fixed angle instrument, the sample intrudes into a plane that is at an increased angle to the plane of rotation, thereby increasing the space envelope required. In an axial centrifuge, the sample rotates around an axis that is parallel to the sample tube, and this axis runs either through the center of the tube diameter Fig. The g force field geometry applied to the sample and developed for this new centrifuge enables high sample throughput rates without the use of excessive or prolonged centrifugal force. The sample position is illustrated in Fig. This geometry and operation act to give the double advantages of angled centrifugation and the ability to allow the sample to swing to an upright position at the end of the cycle. The use of deliberately angled tubes gives the benefit of reduced centrifuge spin time because of the shorter sample path-length needed to achieve centrifugal separations. The use of angled centrifugation in a single plane coincidentally reduces the space envelope requirements for the rotors. Open in new tab Figure 3. Diagrammatic representation of the different ways in which samples are held and centrifuged relative to the axis of rotation. A , axial; B , fixed angle; C , axial; D , the Multifuge. In C, the rotational axis is parallel to the tube and runs either through the center of the tube i or through an external point ii. The requirement to balance the centrifuge rotor is minimized because each rotor has a built-in imbalance, which when a sample is loaded effectively balances the rotor. The amount of imbalance required was determined from a study of the tube sizes and tube fill characteristics actually used in several different laboratories. This has allowed centrifugation without the need to balance each sample. In its present hardware configuration, using 12 rotors, the centrifuge time can be controlled by the user by changing the carousel rotational speed, to give individual sample cycle times ranging from 2. This throughput rate can be increased either by reducing the sample cycle time or by increasing the number of rotors used. The relationship is given by: The number of rotors can be increased by making hardware changes at the point of manufacture, but this increases the footprint. The centrifuge is controlled by any conventional personal computer. Individual rotor speeds are also user selectable up to a limit of rpm. This means that, if required, all of the rotors could be running at different speeds within one rotation of the carousel. The serial nature of working allows for accurate tracking of samples. This is a useful feature when dealing with current inquiries about the analytical status of a particular sample. The use of a personal computer as a front end allows password-protected operation to enforce centrifugal patterns as directed by senior staff. In the present model, sample presentation is from an endless belt, moving around two fixed fulcrum points. The distance between these points are user configurable between 25 cm and 3 meters, allowing more than one operator to access the loading function at the same time. Understandably, the first attempt to automate the process of centrifugation would use as its model an adaptation of manual handling. Thus, a robotic arm would provide pick and place operation to load and unload a centrifuge Zymark. The actual order of placement or removal from the centrifuge is not

important if bar-coding is used and there is a reader within the overall procedure. This approach is likely to require more than one centrifuge if a continuous function is required because of the delays inherent in sample loading and unloading by robotic arms. It does not answer the problem of dealing with emergency samples when the loaded centrifuge may have only one or two samples in process, causing delays to the more routine samples. More importantly, the use of multiple units might reduce overall reliability and increase capital costs. There have been other interesting approaches to the problem of providing serial centrifugation of discrete samples. These use axial centrifugation. In the first approach, samples are spun around their own longitudinal axes 1 2 necessitating high speeds because of the short pathlengths; in the second approach, samples are spun around an external pivotal point 3. In both approaches, the separated blood sample is distributed on the side walls of the sample tube and not at the bottom of the tube, as it is in radial centrifugation in which the sample tube is at right angles to the axis of rotation. In both cases, special blood collection tubes are required that are unique to the separation process and to the stabilization of the separation. Tube handling is by conventional robotic arm pick and place 1 or in a self-contained unit 2. This is clearly too slow to match the analytical rate of multichannel analyzers unless multiple units are used. There is also available 4 a system of automatically processing a whole blood sample into measured aliquots of plasma, but this is not a serial continuous activity and would not be easily accommodated into the routine of a clinical laboratory. There have been some attempts at automated centrifugation in which the centrifugation is inextricably incorporated into the analytical system.

Chapter 8 : Observations on Centrifugation: Application to Centrifuge Development | Clinical Chemistry

Centrifuging The following thumb rules useful for installation guide to sugar industry equipment sizing. These all are giving an instant approximate idea for cross check the existing system.

Chapter 9 : Table of contents for Beet sugar handbook

A laboratory centrifuge is a piece of laboratory equipment, driven by a motor, which spins liquid samples at high speed. There are various types of centrifuges, depending on the size and the sample capacity.