

CELEBRATING
COMMERCIALISATION
YEAR 2014

iiindex 2014

AN INTERNATIONAL EXPOSITION ON RESEARCH AND INNOVATION

invention
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exposition 2014

INNOVATEUR
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2014

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UNIVERSITI TEKNOLOGI MARA
MALAYSIA

*Bridging
the valley of death :
advancing the
commercialisation
of research*

RESEARCH BOOK

iiindex2014

AN INTERNATIONAL EXPOSITION ON RESEARCH AND INNOVATION

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FOREWORD

The Honourable Minister of Science, Technology and Innovation (MOSTI) has launched 2014 as Malaysia Commercialisation Year 2014 (MCY2014) with the theme Science Technology and Innovation (STI) for Wealth Creation. In line with this theme, Invention, Innovation, Design & Exposition 2014 (iidex2014) is an annual exposition organized by UiTM and is the ultimate platform to highlight and commercialise new inventions and innovations. Researchers and inventors will exhibit their products which cater to the needs and wants of the community and the country.

The iidex2014 creates a new dimension by fusing two competitive concepts, a competition among innovative products and a competition to invite Innovateur Wannabes to perform live pitching of their products to the audience. The iidex2014 focuses on comprehensive commercialization and creating opportunities for entrepreneurs to carry out R&D as well as to provide avenue to commercialise their products. Through expositions such as iidex2014, MOSTI hopes to inculcate the culture of commercialisation of new technology designed and created by Malaysians.

I wish to congratulate all the participants of the iidex2014 and this is the opportunity for all researchers to show their ideas and exhibits their products and creativity. Apart from showcasing their products, innovators will have the opportunity to provide a window to the industry for business matching during the exposition.

Tan Sri Dato' Sri Sallehuddin Mohamed
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ONLINE MONITORING SYSTEM OF RESPIRATION (OXYGEN TRANSFER RATE) OF MICROORGANISMS IN AEROBIC FERMENTATION

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Facultative microorganisms can be grown either in aerobic or anaerobic system. Both conditions will end up with different metabolic pathways which may also be influenced by certain inhibitions or limitations. Substrate, oxygen or product limitations or inhibitions are some of the examples. For aerobic system, oxygen transfer rate (OTR), oxygen uptake rate (OUR) and respiration quotient (RQ) are significant parameters which must be investigated and monitored during fermentation. However, during screening, since most of the researchers run fermentation in shake flask in which online monitoring is highly lacking or ignored, it may lead to uncertain or unwanted screening strategies or metabolic pathways. Shake flask is the common bioreactor system prior to screening. Most problems which occur are due to oxygen limitation conditions in the shake flask before the large scale fermentation is being conducted without being realized by the researcher. Some conditions which imitate or are created for any nearly anaerobic conditions are not fully defined or noticed since the OTR, OUR and RQ are not closely being monitored during shake flask fermentation. The metabolic pathways of the microorganisms may change due to the unwanted growth during fermentation. Above all, consequently, online monitoring system (real time data) for respirations of facultative microorganism during screenings prior to large scale fermentation must be established. In this setup, the oxygen and carbon dioxide concentration during fermentation are monitored real timely. The lag, exponential, stationary and death phases could be identified in normal shake flasks which are commonly used by all biological scientists in the laboratory. With this establishment, the problem of unknown screening strategies could be evaluated which would then optimize the unwanted cost of screening strategy for any product based fermentation in bio-processing industry. Most common bacteria which behave facultatively are *Escherichia coli* or any yeast such as *Saccharomyces cerevisiae* are investigated this setup. The design setup consists of shaking, growing and data collecting mechanisms. Screenings of microorganisms in the shake flasks are influenced by many parameters like temperature, shaking frequency, filling volume, inoculum size and age, shaking diameter, OTR and OUR are monitored and RQ can be analyzed from the data collected. Oxygen and carbon dioxide sensors must be implemented in the shake flask for the online monitoring of the fermentation. During any aerobic fermentation, oxygen is consumed and carbon dioxide is released in shake flask. Therefore, the oxygen and carbon dioxide sensors collect the real time data from the beginning until the end of the fermentation monitoring, the lag, exponential, stationary and death phase. The specific growth rate can be monitored during the exponential phase with this monitoring. The lag phase can be minimized with the change of certain parameters involved like filling volume and inoculums size. The higher filling volume will result in longer adaptation to fermentation resulting in longer lag phase. The younger the inoculums, the shorter the lag phase, resulting in abrupt exponential phase with higher specific growth rate of microorganisms. With the monitoring of the screening process, some costs incurred due to falsely grown microorganisms leading to false or lesser production rate can decrease.