DEVELOPMENT OF DIGESTION TECHNIQUES FOR THE DETERMINATION OF TOTAL PHOSPHORUS IN NATURAL RUBBER LATEX

BENYANAN PANWONG

A Thesis Submitted to the Graduate School of Naresuan University
in Partial Fulfillment of the Requirements
for the Master of Science Degree in Chemistry
July 2012

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This thesis entitled "Development of digestion techniques for the determination of total phosphorus in natural rubber latex" submitted by Benyanan Panwong in partial fulfillment of the requirements for the Degree of Master of Science in Chemistry is hereby approved.

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ABSTRACT

The total phosphorus residue in natural rubber (NR) latex which obtained from concentrated NR latex manufacturing process affected the quality of NR latex and the formation of the products. Molybdenum blue spectrophotometric method is a general method for the determination of total phosphorus. However, total phosphorus residues in NR latex could not be directly determined by this technique because the NR latex has a colloidal characteristic which can obstruct the penetration of light beam. Thus, in this work the possibility of sample digestion by UV digestion unit and thermoreactor were investigated. It was found that the UV-assisted digestion and thermoreactor coupled with 30 g L^{-1} ammonium peroxodisulfate as oxidizing agent could be used for NR latex digestion before total phosphorus residue determination by UV-Vis spectrophotometry and digital image-based colorimetry-artificial neural networks (DIC-ANNs). The calibration graph was linear over the range of 0.1 – 1.0 mg L^{-1} (R^2 = 1.0000). The results obtained from both techniques show no statistically significant difference at 95% confidence level by applying paired t-test. The proposed methods were successfully applied to the determination of total phosphorus in NR latex and it was found to be simple, rapid, accurate, precise and low cost method.

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ABBREVIATIONS

UV	=	Ultraviolet
Vis	=	Visible
DIC	=	Digital image-based colorimetry
ANNs	=	Artificial neural networks
NN	=	Neural network
CCD	=	Charge coupled device
CMOS	=	Complementary metaloxide semiconductor
LED	=	Light emitting diode
DC	=	Direct current
RGB	=	Red, green and blue
MSE	=	Mean square error
NR latex	=	Natural rubber latex
DRC	=	Dry rubber latex
DAHP	=	Diammonium hydrogen phosphate
DAP	=	Diammonium phosphate
W	=	Watt
DI	=	Deionized water
°C	=	Degree Celsius
COD	=	Chemical oxygen demand
%RSD	=	Percentage relative standard deviation

ABBREVIATIONS (CONT.)

SD	=	Standard deviation
LOD	=	Limit of detection
LOQ	=	Limit of quantitation
AR grade	=	Analytical reagent grade
PTFE	=	Polytetrafluoroethylene
JPEG	=	Joint photographic experts group
kΩ	=	kiloohm
N	=	Normal
mL	=	milliliter
nm	=	nanometer
mm	=	millimeter
g	=	gram
$g\ L^{-1}$	=	gram per liter
$g\ mol^{-1}$	=	gram per mol
$mg\ g^{-1}$	=	milligram per gram
$mg\ kg^{-1}$	=	milligram per kilogram
$mg\ mL^{-1}$	=	milligram per milliliter
$mg\ L^{-1}$	=	milligram per liter (ppm)
$\mu g\ L^{-1}$	=	microgram per liter