

## EDXRF1877 - $\text{TiO}_2$ & $\text{ZnO}$ in Lotions



### Scope

This application note demonstrates the measurement of titanium dioxide ( $\text{TiO}_2$ ) and zinc oxide ( $\text{ZnO}$ ) in lotions using [NEX QC+](#).

### Background

$\text{TiO}_2$  is added to lotions, creams, and various cosmetics as a whitening agent and acts as a sunscreen.  $\text{ZnO}$  is added as a sunscreen and is very effective at blocking UV light. Its concentration is a factor in determining the SPF (sun protection factor) of lotions and creams.  $\text{ZnO}$  is also a mild astringent with mild antiseptic properties used in lotions and creams to help retain moisture, provide a protective layer to the skin, and prevent diaper rash in baby products. When iron oxide ( $\text{Fe}_2\text{O}_3$ ) is also added the  $\text{TiO}_2$  (white) and  $\text{Fe}_2\text{O}_3$  (red) are blended in various proportions to create the many shades of reds and browns in cosmetics, make-up, rouge, and lipsticks.

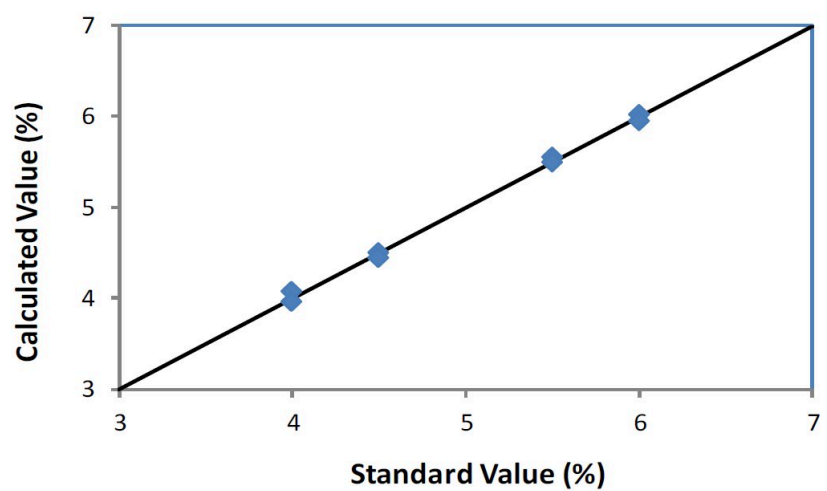
### Calibration

Calibration is a one-time procedure using standard empirical regression. In this demonstration, eight calibration standards with independently varying levels of  $\text{TiO}_2$  and  $\text{ZnO}$  were used. Automatic correction factors are calculated by the calibration to compensate for X-ray absorption/enhancement effects between Ti and Zn.

#### $\text{TiO}_2$

Element: Ti
Units: %

Sample I.D.	Standard value	Calculated value
1	4.00	4.08
2	4.50	4.50
3	5.50	5.55
4	6.00	6.02
5	4.00	3.96
6	4.50	4.44
7	5.50	5.50
8	6.00	5.95

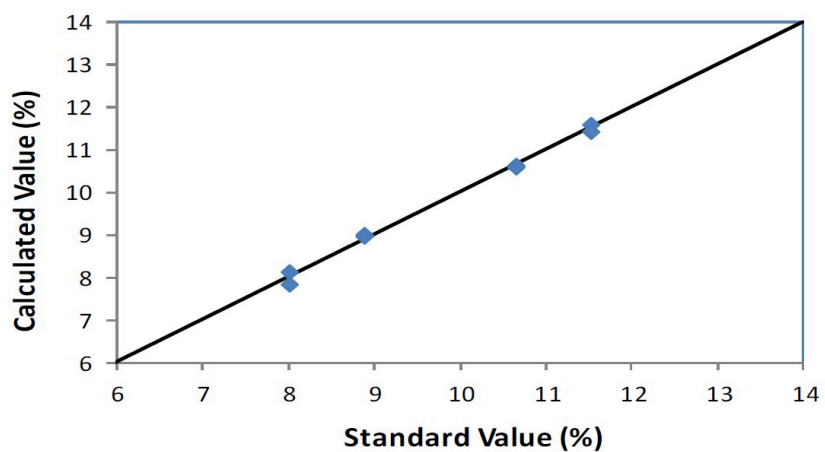


Correlation plot  $\text{TiO}_2$  in lotion

## ZnO

Element: Zn		
Units: %		
Sample I.D.	Standard value	Calculated value
1	8.01	8.10
2	8.88	9.00
3	10.64	10.63
4	11.52	11.59
5	11.52	11.41
6	10.64	10.58
7	8.88	8.95

8	8.01	7.84
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Correlation plot ZnO in lotion

## Recovery and repeatability

Repeatability (precision) is measured using 10 or more repeat measurements. Low and high calibration standards were analyzed with 10X repeats to demonstrate effective recovery and analytical precision.

<b>Sample ID: Standard 5</b>				
<b>Units: %</b>				
Component	Standard value	QuantEZ value	Std. dev	RSD (%)
TiO <sub>2</sub>	4.00	3.99	0.008	0.2
ZnO	11.52	11.46	0.038	0.3

<b>Sample ID: Standard 8</b>				
<b>Units: %</b>				
Component	Standard value	QuantEZ value	Std. dev	RSD (%)
TiO <sub>2</sub>	6.00	5.99	0.019	0.3
ZnO	8.01	7.93	0.031	0.4

## Conclusion

The Rigaku NEX QC+ is a compact, simple to operate tool, ideal for at-line quality checks during production as well as in the QC lab. Similar results can also be obtained on NEX QC using slightly longer measurement time. For cosmetics that include Fe<sub>2</sub>O<sub>3</sub>, simply create standards containing the TiO<sub>2</sub>, ZnO and Fe<sub>2</sub>O<sub>3</sub>, the Fe<sub>2</sub>O<sub>3</sub> performance is comparable to the ZnO data shown here.

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## Related products



### NEX QC Series

Combines quality, affordability, and performance for a wide range of applications