A ‘lab-on-paper’ to monitor iodine in salt

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For salt iodization programs to be effective, it is important to monitor iodine content in the salt at various points along the supply chain. Iodometric titration is currently the gold standard, but it requires trained technicians and wet reagents. The rapid test kit (RTK) is the most common method to measure coverage of iodized salt in household surveys due to its affordability and feasibility, but it is not able to distinguish whether or not the salt is adequately iodized (1). As a result, other methods have been developed to make testing more precise and affordable, including the Bioanalyt iCheck IODINE® and the WYD Chinese checker (2).

With the financial support from GAIN, researchers at the University of Notre Dame (Indiana, USA) have developed the saltPAD, a paper test card that can measure how much iodate is present in a sample of iodized salt. The saltPAD combines some of the best features of RTKs (ease of use, usability in field settings) and titration (accuracy). SaltPADs can be used in a field setting like RTKs, but they are accurate to the part-per-million levels needed to perform quality control in a factory, to carry out regulatory monitoring, or to evaluate levels of iodization in household salt. By varying the dilution of the salt sample, the test cards can be used to evaluate production levels, which are typically 30–50 ppm, or market and household levels, where the target iodization levels are 15 or 20 ppm. SaltPADs require 1/100th of the chemicals needed for standard titration, which means they generate less waste.

Each card contains several reaction zones, printed on the paper with waxy ink. The reagents needed to perform an iodometric titration are stored in the paper. Instead of adding portions of the titrant to the salt sample, the user mixes a solution of the salt sample with water and drops the solution onto the twelve reaction areas on the card. The reaction zones contain varying levels of the titrant, which allows different iodine thresholds to be measured. The number and intensities of the blue dots can be compared with a printed standard image to evaluate the test result (Figure 1), or the user can take a picture with a cell phone and send the image for automated image analysis. An image analysis program logs the data and the result, which may be useful for improving documentation of salt analyses, especially in household and market surveillance.

GAIN is currently supporting an external validation of the saltPAD in South Africa. About 1000 PADs will be used to analyze samples in a blinded study in order to assess their accuracy and precision. If the saltPADs perform well, they may be an important step forward to improve the monitoring of iodized salt in low-resource settings.

References


The University carried out an internal validation test in their lab and a field test at Kensalt, a salt manufacturer in Mombasa, Kenya. The president of Kensalt, Mr. Debesh Sengupta, was interested in a technology that could allow closer monitoring of salt production, and he arranged a trial using portions of processed salt collected over several days. Quality control technician Richard Mbaru quickly learned how to use the saltPAD efficiently and how to interpret the results using standard images. Mr. Mbaru was able to perform the paper-based titration twice as fast as glassware titration. Another benefit of the saltPADs is that they require a much smaller quantity of deionized water, which is a major cost element of the titration method.

![Richard Mbaru, a quality control technician at Kensalt, analyzes salt samples made in the production suite.](image-url)