CHEMISTRY LETTERS, pp. 2045 - 2046, 1984. © The Chemical Society of Japan 1984

A CONVENIENT SYNTHESIS OF N-BROMOAMIDES BY USE OF SODIUM BROMITE

Shoji KAJIGAESHI,* Takashi NAKAGAWA, and Shizuo FUJISAKI
Department of Industrial Chemistry, Faculty of Engineering,
Yamaguchi University, Tokiwadai, Ube 755

Reaction of aliphatic and aromatic amides in acetic acid with aqueous sodium bromite ($NaBrO_2$) under mild conditions gave N-bromoamides in fairly good yields.

In recent years, sodium bromite has been proved to be a useful reagent in organic synthesis.$^{1-3)}$ During our studies on the synthetic utilities of sodium bromite, we found that sodium bromite is used very effectively as a reagent for the Hofmann degradation of amides,$^{4)}$ and the haloform reaction of methyl ketones.$^{5)}$

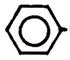
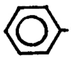
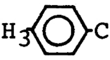
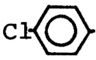
We have now found that amides (1) react with sodium bromite in acetic acid under mild conditions to give N-bromoamides (2) in fairly good yields. The treatments of 1 in acetic acid with aqueous sodium bromite were carried out at room temperature for 3-4 h under stirring. The results are summarized in Table 1.

$$\underset{\underline{1}}{\text{R-CONH}_2} \xrightarrow[\text{rt, 3-4 h}]{\text{AcOH, aq NaBrO}_2} \underset{\underline{2}}{\text{R-CONH-Br}}$$

Although N-brominations of 1 with bromine and alkali have been widely investigated as the first step of Hofmann degradation,$^{6)}$ it is not so easy to isolate 2 because the subsequent reactions of 2 should proceed more readily under the alkaline conditions. There are some examples for the preparation of 2 which are reported by use of special techniques.$^{7-9)}$

Our method is straightforward and simple to use, and applicable to synthesis of various aliphatic and aromatic N-bromoamides except lower aliphatic N-bromoamides which are unstable under the operating acidic conditions. Nevertheless, we were still unable to indicate clearly any active brominating species for the N-bromination of amides with sodium bromite in the presence of acetic acid.

Table 1. N-Bromoamides (2) prepared

Entry	Product (2)	Yield$^{a)}$/%	Mp/°C$^{b)}$	Active bromine/% Calcd	Active bromine/% Found
1	$CH_3(CH_2)_6CONHBr$ (2a)	81	63-65	36.0	34.5
2	$CH_3(CH_2)_8CONHBr$ (2b)	88	74-76	31.9	28.7
3	$CH_3(CH_2)_{10}CONHBr$ (2c)	90	85-87	28.7	28.7
4	$CH_3(CH_2)_{12}CONHBr$ (2d)	98	86-88	26.1	25.4
5	$CH_3(CH_2)_{14}CONHBr$ (2e)	97	85-87	23.9	23.0
6	$CH_2CONHBr$ (2f)	60	126-129	37.3	36.6
7	CONHBr (2g)	70	128-131 (129-131)$^{8)}$	40.0	38.7
8	CH_3CONHBr (2h)	75	130-133 (131-133)$^{8)}$	37.3	36.7
9	NO_2CONHBr (2i)	96	207-209 (198-202)$^{8)}$	32.6	31.9
10	ClCONHBr (2j)	96	175-177 (170-174)$^{8)}$	34.1	33.0

a) Yield of isolated product. b) Uncorrected.

A general and typical procedure is as follows: To a solution of benzamide (1g) (1 g, 8.3 mmol) in acetic acid (7 ml) is added dropwise slowly s solution of 94.7% sodium bromite$^{10)}$ (2 g, 14 mmol) in water (3 ml) at room temperature under stirring, and then the reaction mixture is further stirred for 3 h. The precipitate obtained is filtered, washed with water (30 ml) and dried. The white product, identified as N-bromobenzamide (2g), weighed 1.16 g (70% of the theoretical amount); mp 128-131 °C.

References

1) T. Kageyama, S. Kawahara, K. Kitamura, Y. Ueno, and M. Okawara, Chem. Lett., 1983, 1097.
2) T. Kageyama, Y. Tobito, A. Katoh, Y. Ueno, and M. Okawara, Chem. Lett., 1983, 1481.
3) T. Kageyama, Y. Ueno, and M. Okawara, synthesis, 1983, 815.
4) S. Kajigaeshi, T. Nakagawa, S. Fujisaki, A. Nishida, and M. Noguchi, Chem. Lett., 1984, 713.
5) S. Kajigaeshi, T. Nakagawa, N. Nagasaki, and S. Fujisaki, submitted for publication in Synthesis.
6) E. S. Wallis and J. F. Lane, "Organic Reactions," ed by R. Adams, John Wiley & Sons, Inc., New York (1946), Vol. 3, p. 267.
7) E. P. Oliveto and C. Gerold, Org. Synth., 31, 17 (1951).
8) C. R. Hauser and W. B. Renfrow, Jr., J. Am. Chem. Soc., 59, 121 (1937).
9) T. D. Waugh and R. C. Waugh, U. S. Patent 2971959 (1961); Chem. Abstr., 55, 14483 (1961).
10) Commercial sodium bromite is now available from Kanto Kagaku Co. Ltd.

(Received September 3, 1984)