Complexes of Alizarin Fluorine Blue containing Two Different Metals

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ALIZARIN FLUORINE BLUE (AFB, 1,2-dihydroxyanthraquinon-3-ylmethylamine-*NN*-diacetic acid) is used extensively as a reagent for fluoride,[1] as the formation of the blue ternary complex AFB–La^{III}–F (λ_{max} 567 nm.) at pH 4·5 was thought to be specific for this anion. It has recently been shown that the AFB–UO_2^{2+} complex is also blue (λ_{max} 560 nm.)[2], and Hall noted that various mixtures of metal ions, one of which should be an "early" lanthanide, also gave blue complexes with Alizarin Fluorine Blue at pH *ca.* 4·5.[3] In an investigation of this reaction we have examined the interaction of many mixtures of cations with AFB and have reached the conclusion that Hall in fact hit upon the two best examples of this effect (Table).

Examination of the formation of the La–Ni–AFB complex by spectrophotometry indicates that the combining ratio is La, Ni, $(AFB)_2$, in which case the reaction bears a marked similarity to the formation

TABLE

Complex	λ_{max} (nm.)
La^{III}–AFB	490
Co^{II}–AFB	500
Ni^{II}–AFB	500
(La + Co)–AFB* ..	530
(La + Ni)–AFB*	550

* Ref. 3

of the ternary $[Cu^{II}Cr^{III}(citrate)_2]^{3-}$ complex recently described by Irving.[4]

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[1] M. A. Leonard, in "Organic Reagents for Metals and Certain Radicals," ed. W. C. Johnson, vol. 2, Hopkin and Williams, Chadwell Heath, Essex, 1964.
[2] Second S.A.C. Conference 1968, Society for Analytical Chemistry, London; Paper No. 20.
[3] R. J. Hall, *Analyst,* 1963, **88**, 76.
[4] H. M. N. H. Irving and W. R. Tomlinson, *Chem. Comm.*, 1968, 497.